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No. 10.

NATURAL SCIENCE:

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NATURAL SCIENCE:

A Monthly Review of Scientific Progress.

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NOTES AND COMMENTS.

The Interior of the Earth.

A MORE or less interesting article, by the Rev. O. Fisher, entitled "The Hypothesis of a Liquid Condition of the Earth's Interior, considered in connection with Professor Darwin's Theory of the Genesis of the Moon," appears in the last number of the *Proceedings of the Cambridge Philosophical Society* (vol. vii., pt. 6, 1892). We say more or less interesting, because mathematical formulæ occupy a considerable portion of the paper, and these do not, as a rule, in themselves, interest students of Natural Science. Indeed, a serious regard for the published results of the application of rigid mathematics to the study of the earth, does not seem hitherto to have penetrated deeper than the superficial strata of the magazine article and the student's text-book. The dry flour of the mathematical mill makes excellent paste for holding together the *disjecta membra* of a popular lecture; but it never seems to have commended itself as digestible pabulum to the taste of the everyday geologist, who has his day's work to do, and needs something substantial and nourishing to do it upon.

In his "Physics of the Earth's Crust" (edition 2), Mr. Fisher claims to have proved that if the crust is as thin as some geologists suppose, and if the age of the world is anything approaching to what geological phenomena appear to indicate, then there must exist convection currents in the interior, which prevent the crust from growing thicker, by melting off the bottom of that crust nearly as fast as it solidifies. He made no suggestion in that work to account for such currents being maintained. At present, however, he thinks that the observations of Professor G. H. Darwin on bodily tides may furnish an explanation; for a certain amount of heat is generated in the interior of the earth—greater, in proportion, as we approach its centre—by

the action of the tidal couple upon the substance of that interior. "The whole heat generated, from first to last," says Professor Darwin, "gives a supply of heat, at the present rate of loss, for 3,560 millions of years."

Re-investigating, mathematically, "the effects of the tidal yielding of the earth, on a tide of short period, according to the canal theory," Mr. Fisher reaches the conclusion that on an earth with a liquid interior and a solid crust, ocean tides would exist, of the same type as those upon a solid earth. The amount of tide in the former case would be about two-fifths of the amount of what it would be in the latter. This he considers to be "a sufficient answer to the objection brought against the theory of internal liquidity, that in such a case there could be no measurable ocean tides."

He points out that the conclusion, that in a solid globe nothing short of a high degree of rigidity could sustain the weight of continents and mountains, disappears wholly in the light of Airy's hypothesis that the crust is supported in a state of approximate hydrostatic equilibrium on a yielding nucleus. Hence, all conclusions drawn from the supposed necessity of a high degree of viscosity, vanish with it; so that all numerical estimates founded upon this must be wholly inapplicable in the case of a liquid interior.

Mr. Fisher next goes on to show that on the tidal theory the whole estimated amount of heat generated in the earth remains the same, whether the question of time be considered or not. He holds that if we take this total amount of heat, as given above, it is difficult to understand how it can possibly have been dissipated. Under present conditions only a very small portion of the heat generated in this manner could be taken up by the ocean waters and radiated into space. "Unless ocean tides have been in operation for a length of time exceeding any estimate hitherto suggested, it does not appear probable that any considerable portion of the heat generated, according to the hypothesis of the moon being shed from the earth, can be got rid of by this means." Unless this heat is accumulating, it must have been got rid of by (1) "Conduction through the solidified crust; (2) by transference of internal heat to the surface by volcanic action; or (3) by conversion of heat into work against gravity, &c."

He then calculates that the amount of heat carried off by conduction through the earth's crust, even in 100 millions of years, must be quite inconsiderable compared to the full amount presumably generated in the interior. Next, as an extreme case of volcanic action, he shows that presuming the ocean to be four miles deep, and covering the entire globe, and that the whole of its waters were originally in solution with the magma of the earth, and are now cooled down to the freezing point, the total reduction of heat by this process would only use up 8° F. of the 3,000° F. to which the interior is estimated to have been heated; and, lastly, supposing heat has

been expended in producing elevations of strata, in inducing molecular changes in rocks, in shearing, &c., still the amount thus expended cannot represent more than a fraction of the whole, for the work of elevating a layer of granite-rock ten miles in thickness for a height of five miles, would represent the heat equivalent to a fall of temperature of only 1° F. throughout the globe.

Mr. Fisher concludes that there appear to be only two possible replies to the question as to what becomes of the estimated heat generated by this tidal action. Either the earth's crust solidified a very long while subsequent to the genesis of the moon, and so was able to radiate heat directly from its liquid surface into space; or else the moon was not thrown off at all, but was left behind, according to the nebular hypothesis. In this latter case, the whole amount of tidal action would not have been so great, but still quite sufficient to generate centrically an amount capable of maintaining those internal currents which the theory of a thin crust and a liquid interior appear to necessitate.

The Thames as an Agent in the Dispersal of Plants.

In the recently issued number of the Linnean Society's *Journal* ("Botany," vol. xxix., pp. 333—346), Mr. H. B. Guppy gives the results of his observations on the agency of the Thames and its tributaries, the Lea and Roding, in the dispersal of plants. Not only in autumn, but during winter and spring, seeds, seed-vessels, and other vegetable drift are constantly carried sea-wards, the months of January and February yielding the richest collections—a fact to be explained by the numerous checks to their progress. A constant wind, blowing at right angles to the river course, will cause a surface-flow across the stream, carrying out of the current much of the drift which is thus often caught in the flags near the side, or embayed for weeks in a sheltered hollow of the bank. In the tortuous channels of the lower Lea, where the current is slow, large collections may be found in the spring in some of the bends, especially after a long spell of east wind. A flood will leave much material stranded until the next one picks it up again. Eddies will detain the drift for days, and, when the tidal part is reached, there is no knowing how many times it may get carried to and fro; when a seed-vessel arrives off Gravesend, it has probably traversed the distance below Teddington weir many times over.

Mr. Guppy has worked the Thames from Richmond up to Sunbury weir. By using the tow-net, he says, opposite the weirs, and collecting the drift in other places where it had become embayed or caught in the flags, he has gathered in a day materials for months of work; not only seeds and seed-vessels are captured, but bits of stem and branches, from which, if provided with a node, the plant may often be reproduced. Plants of *Scutellaria galericulata* and *Nasturtium* were raised in this way from small fragments. Shoots of forget-

me-not (*Myosotis palustris*) and other plants are present in numbers with shoots and buds of several of the Potamogetons and the arrow-head. Many grub-cases are found, and numerous other minute forms of life.

Collections from the drift of the Thames and Lea have much the same composition. From October, when seeds and fruits first begin to accumulate in any quantity, through the winter to February and March, there are always to be found floating in these rivers, usually in numbers, the achenes of *Ranunculus repens* and *R. sceleratus*; the nuts of *Lycopus europæus* and *Scutellaria galericulata*; fruits of *Atriplex patula*, and several species of *Rumex*; the mericarps of *Angelica*; the nuts of the alder and birch; the drupes of *Sparganium ramosum*, the carpels of the water plantain, and the fruits of different species of *Carex*. Less frequent are the black carpels of *Galium palustre*, and the seeds of the yellow flag. The Thames is distinguished from the Lea by the number of seeds of *Impatiens fulva* and the yellow-rattle (*Rhinanthus crista-galli*), while fruits of *Bidens* are more frequent in the Lea. Most of the seeds and fruits in the spring drift have floated through the winter; nuts of alder and birch, however, are continually dropping from September to June; those of the birch only float a few days, and yet are plentiful in the drift during February and March. Except the birch-nuts, all these seeds of the river drift germinate in the water in March and April, or even before, and in nearly every case the germination is completed at the surface, where the seedlings, as a general rule, float and thrive, developing the first few leaves, but never attaining a greater length than an inch or two, though if stranded on a mud-bank they readily strike and develop the full-sized plant.

The ice of an English winter was found by Mr. Guppy not to affect the germinating power of the seeds in our ponds and rivers. In the case of several of the above-mentioned seeds which had been cased in ice for twenty days, as large a proportion germinated as when they were not thus enclosed. In the shallow water of the Lea when the water was frozen to the bottom, the underlying mud was also frozen for an inch or so, coming up in a continuous mass with the ice; and shoots of forget-me-not taken up in this manner are still alive. Though the power of germination is unaffected, great numbers of the seeds and fruits sink to the bottom after the thaw, the ice affecting the vitality of the outer coverings or buoyant parts of the fruit, a process which is a direct aid to germination in the case of *Sparganium ramosum* and *Potamogeton natans*. The ice also sends to the bottom about half the fronds of the floating duck-weed; in fact, it may be generally stated that after a thaw the river is cleared of a large proportion of the drift.

When a germinating seed gets enclosed in ice, germination is arrested; but after the thaw the process is often rapidly completed, and a diminutive seedling prematurely discharged. This occurs, for

instance, in *Rumex conglomeratus*, but in the case of *Ranunculus repens* and *aquatilis* the process is often permanently checked. Some seedlings will develop the first leaves during the daily thaw, while locked in the ice at night.

The seeds and fruits of the river drift will, almost without exception, float for months in sea-water, and afterwards germinate. Fruits of *Sparganium ramosum* germinated after being afloat in sea-water for a year, and those also of many others after periods of from three to five months, the limit not of their buoyancy but of the experiment. The sinking of a seed-vessel in sea-water by no means involves the loss of germinating power of the seed; on the contrary, it sometimes favours the process, as the sinking is due to loss of vitality of the outer coverings on which the buoyancy of the fruit nearly always depends, and the decay of these coverings is often a necessary step to germination. Thus nuts of *Potamogeton natans*, which float for months in fresh-water, sink after a week or two in sea-water; until they are ready to sink they cannot germinate, so that sea-water quickly accomplishes what may take months in fresh-water.

As regards seeds already germinating that may reach the sea, in those of *Rumex* the process is arrested, and the protruding part of the radicle rots off; but if after a week or two fresh-water is again reached, the process is recommenced, and an undersized seedling prematurely discharged, which, however, soon recovers, and develops the plumule. In the yellow flag the radicle soon rots off, and germination is not continued when the seed is restored to fresh-water. Rarely is the germinating seed but little affected, as in *Ranunculus sceleratus*, which will germinate in sea-water.

As regards seedlings, some such as the yellow water-lily, the water-plantain, and *Mentha aquatica*, are killed by sea-water in a day or two and sink. Others will float for a week or ten days and yet recover, though often much mutilated. The seeds of *Salicornia herbacea* sink even after a winter's drying, yet they germinate freely, and the seedling rises to the surface and thrives.

Mr. Guppy remarks on the absence in the river-drift of the seeds and seed-vessels of most of the familiar water-plants; in fact, we find represented the plants that live on the banks rather than those of the water. With two or three exceptions the nuts of the pond-weeds are absent, as are the seeds of the yellow and white water-lilies, the fruits of the forget-me-not (*Myosotis palustris*), the water ranunculus (*R. aquatilis*), and even the nuts of *Polygonum amphibium*. Nor do we find the fruits of the hornwort (*Ceratophyllum demersum*) or the nuts of the bulrush (*Scirpus lacustris*). The missing seeds and fruits, however, have little or no floating power either in river or sea, and must be sought in the river mud. Now these plants have a very wide distribution, many being universal in fresh-water ponds and rivers, and yet they cannot of themselves cross the sea. It is to birds that we must look for the dispersal of many of our water-plants,

either by conveying them long distances in their crops or digestive canals, or less frequently in the mud sticking to their feet or plumage.

In conclusion, the author mentions some interesting experiments on a few plants. The frog-bit (*Hydrocharis morsus-ranae*) is largely propagated in this climate by buds, many of which float through the winter till spring, when they develop into the characteristic plant. Plants were raised not only from these, but from buds that had been enclosed some weeks in ice, or had sunk after floating a week or more in sea-water. The seeds sink both in fresh and sea-water, but would readily adhere to the plumage of a water bird by means of the gelatinous pulp in which they are surrounded when discharged from the fruit; they could thus be easily transported. The detached leaflets of *Cardamine hirsuta* are found floating in numbers in the drift of the Thames and Lea, and the ponds of Epping Forest from autumn to spring. From some which had been kept afloat all the winter plants were reared, and also from leaflets that had been several weeks in ice; but a week of sea-water destroys the reproductive power. Finally, as regards the duckweeds. Fronds of *Lemna minor* collected in the Lea in October remained afloat through the winter, and are now thriving; in fact the fronds were found during every month of the year, sometimes in quantity enclosed in ice. The seeds will germinate after floating a day or two in sea-water, but a week's immersion kills them. Sea-water kills most of the fronds, even after a day's floating; some, however, recover and in rare instances survive a week in the sea. In rainy weather they can withstand an exposure of one or two days, and might thus be carried some distance on a bird's plumage. *Lemna gibba* apparently disappears in the winter, and *L. polyrhiza* is represented only by small rootless fronds. *L. trisulca* seems to live through the winter in the Thames and Lea; and it was found enclosed in quantity in the ice of an Epping Forest pond after weeks of frost. The fronds of the three last species behave like those of *L. minor* in sea-water.

An Ancient Lake-Village in Somersetshire.

We have already had occasion to refer to the scarcity of remains of Lake-dwellings in England (*suprà*, pp. 40–43), and it is gratifying to be able to record a newly-discovered example in Somersetshire. In the *Times* of October 24, Dr. R. Munro calls attention to this discovery, which was made by Mr. Arthur Bulleid, of Glastonbury, and his observations are of so much interest as to be worthy of special quotation. The site is about a mile north of Glastonbury, on the road to the village of Godney; and, before excavation, the remains consisted of a number of low mounds, rising from one to two feet above the surrounding soil, and extending from 20 to 30 feet across.

Dr. Munro, who visited the spot in October, observed that close by a trench through one of the mounds, there were three oak beams, lying over a bed of decayed brushwood, and evidently *in situ*. Each of these beams contained either two or three mortise holes, and through some of them the top of an upright pile still protruded. Their resemblance to the well-known palisades of the crannogs of Scotland and Ireland was too striking to admit of any doubt. They were evidently part of the marginal structures of a large area of woodwork, but as yet of undetermined limits, over which several cottages with their respective hearths had been placed.

The composition of the mound was disclosed by a succession of well-defined strata of clay, charcoal, ashes, and decayed wood. The total thickness of these beds was 3 ft. 6 in., and within them were detected three separate hearths superimposed one above the other. These hearths were generally formed of large stone slabs placed over a bed of clay, or of small stones embedded in it in the form of a pavement. Underneath the whole was the common woodwork, whose surface here presented a neatly formed layer of round timbers laid close together and still retaining their bark.

So far as ascertained by trial diggings here and there, all these mounds appear to contain a fireplace, thus probably indicating separate dwellings or perhaps workshops; and as their total number amounts to between 60 and 70, extending over an area of some five acres, one can form some idea of the extent of the settlement.

The surrounding district is now richly cultivated, but, in looking over an old map of the date of 1668, Dr. Munro found that it contained a lake called the "Meare Poole," into which three streams debouched, and from which the site of the present discovery could not be far distant. That this lake had larger dimensions in earlier times is probable, so that when this settlement was founded the locality would have been a shallow lake or marsh. Strange to say, this map represents the district lying immediately on the north-west borders of the "Meare Poole," as inhabited by the Belgæ.

The articles at present found include bronze rings, fibulæ and one brooch; also a few decayed iron objects. Other articles formed of bone and horn are numerous. Pottery is abundant, but much broken. Remains of a quern were discovered, and a few other stone articles, including some flakes and cores of flint. Beans, wheat, rye, nut-shells, &c., were found, as well as bones, presumably of domestic animals. So far, however, as the excavations have yet disclosed the nature of its buried treasures, the result is of special interest, owing to the predominance among them of articles unquestionably belonging to the period known as "Late Celtic." Hitherto nothing indicative of Roman influence has come to light, neither coins nor Samian ware being among the relics; and, should this pre-Roman character be maintained, Dr. Munro considers that the complete excavation of the entire village becomes a national duty.

The Study of Living Protoplasm.

In Biology the study of life in its simplest manifestations continues to attract the attention of many investigators, and important progress is being made. Dr. W. Flemming, of Kiel, has a short paper in the *Anatomischer Anzeiger* (vol. vii., pp. 758—764), in which he combats the idea upheld by some authors, that the well-known network observed in the nucleus of certain cells is a false appearance due to accidental and secondary changes in the material during preparation. Dr. E. G. Balbiani (*Ann. Micrographie*, vol. iv., pp. 449–489, pl. iii.) has studied the nucleus from another point of view, namely, in reference to its influence on the growth and reproduction of the cell. Dr. E. B. Wilson (*Anat. Anzeig.*, vol. vii., pp. 732–740) has been experimenting on the developing egg of *Amphioxus*, tearing asunder the segments at various stages in the subdivision, and trying the effect of allowing these parts to continue their development separately.

Dr. Balbiani's investigations were conducted by cutting up the protozoan *Stentor cœruleus*, and observing the process of regeneration in the various pieces. He finds that wounds are soon obliterated, and that each fragment becomes a new *Stentor* whether or not a trace of the nucleus happens to be preserved. The merest trace of a nucleus accelerates repair, but, at the same time, the effect of its total absence is not appreciable until this repair is tolerably advanced. Even when present, indeed, the reconstitution of the nucleus is the last act in the process of regeneration. For the complete restoration of all the parts, however, Dr. Balbiani finds that the constant presence of a nucleus is essential: and he has often observed the death of incomplete specimens, marked by the spongy character of the protoplasm with water forming numerous small vacuoles. He has also sometimes noticed a curious tendency, during regeneration, to a multiplication of the organism by division: and he believes that the nucleoli are exclusively concerned in sexual reproduction.

Dr. Wilson's results are very curious. If an egg of *Amphioxus* that has just segmented into four parts be taken and subdivided into its components, each will usually continue to develop, and will eventually give rise to an oval free-swimming larva one-fourth the normal size, but otherwise quite ordinary in appearance. If this 4-celled stage be allowed to fall into two pieces, each half not infrequently develops successfully, and gives rise to an embryo of half the normal size. Experiments, however, seem to show that if the egg be split into pieces at its 8-celled stage, none of these segments do more than acquire cilia, and swim about actively in their simple state; while, sooner or later, all of them die. The same phenomenon has been observed by Dr. Driesch in Echinoderms.

Rabbits.

Mr. Miller Christy, in a communication "On the Extermination of the Rabbit in Australasia" (*Zoologist*, Nov.), refers to the remarkable periodical variation in numbers exhibited by the *Lepus americanus* in the Canadian North-West. He says that for several years in succession the animal becomes so scarce as to be quite difficult to obtain, increasing in the next few years to so extraordinary an extent as to become the most abundant mammal in the country. After the maximum of increase has been attained, the rabbits commence to die off, and, before many weeks are over, their dead bodies strew the woods in all directions, while a live rabbit is scarcely to be met with. Mr. Christy agrees with Sir John Richardson (1837) that the disappearance is due to an epidemic comparable to the "mouse-typhus" of Löffler. Professor Hind (1860) thought exhaustion following a severe winter accounted for the fact. But the numerous extracts Mr. Christy quotes from many writers who have paid attention to the subject, and more especially a brief newspaper paragraph which professes to diagnose the cases—swollen throat, followed by diarrhœa and death—seem to prove that the disappearance of the rabbits is due to disease. If this be so, and if the bacteriologists can find some virulent disease peculiar to the rabbit, by all means let experiments be tried for the wholesale extermination of the pest in Australia, where, judging from all accounts, the second source of the wealth of the colony, the sheep farm, is rapidly becoming a thing of the past.

Fossil Rhinoceroses.

In a recent memoir published in the *Bull. Soc. Imp. Nat. Moscou* (vol. vi., pp. 146–231, pls. iii.–v.), Madame M. Pavlow continues her elaborate researches on the phylogeny of the Ungulates, treating, in this fasciculus, first of the fossil Rhinoceroses of Russia, and then of the mutual relationships of all the members of the family. The species found in Russia are comparatively few, and as they are all identical with Western European forms, call for no particular remark.

In treating of the phylogeny of the family, the authoress publishes a genealogical table, in which the whole of the Rhinoceroses, both fossil and extinct, are derived from the genus *Systemodon* of the Lower Eocene of North America. That such a characteristically Old World group should have had a Transatlantic origin appears startling, although it is paralleled in the case of the Camels: and we are not at present prepared to admit that the case is proved. Madame Pavlow's genealogical table is open to a considerable amount of criticism, but since Professor H. F. Osborn informs us that he is at present engaged on working out the phylogeny of this group, we think it better to defer such criticism until his memoir shall have appeared. We may state, however, that in attempting to trace the origin of the

living Sumatran and Javan Rhinoceroses through *R. deccanensis* and *R. karnuliensis* of the Indian Pleistocene, the authoress is clearly in error, since, if these species had any lower cutting-teeth at all, it is quite certain that they must have been rudimental ones. It may further be added that, in so widely separating the two-horned Pleistocene Rhinoceroses of Europe from the existing African species, which they resemble in the absence of front teeth, we think that the authoress has decidedly carried the doctrine of "parallelism" to an extreme.

Late Flowering Plants.

While we write, the ivy is in flower, and bees, wasps, and flies are jostling each other and struggling to find standing-room on the sweet-smelling plant. How great must be the advantage obtained by this plant through its exceptional habit of flowering in the late autumn, and ripening its fruit in the spring. To anyone who has watched the struggle to approach the ivy-blossoms at a time when nearly all other plants are bare, it is evident that as far as transport of pollen and cross-fertilisation go, the plant could not flower at a more suitable time. The season is so late that most other plants are out of flower, but yet it is not too late for many insects to be brought out by each sunny day, and each insect, judging by its behaviour, must be exceptionally hungry.

Not only has the ivy the world to itself during its flowering season, but it delays to ripen its fruit till the spring, a time when most other plants have shed their seed, and most edible fruits have been picked by the birds. Thus birds wanting fruit in the spring can obtain little but ivy, and how they appreciate the ivy berry is evident by the purple stains everywhere visible within a short distance of the bush.

The ivy berry, however, has a soft seed with a large unprotected embryo, which is totally destroyed by digestion; yet the conspicuous glossy blackness is evidently employed to attract birds. How can birds be of use to a plant thus endowed? It seems probable that in this case, as with many other abundantly-fruiting plants, a large proportion of the fruit acts merely as bait and thus allows by accident a small proportion of the seeds to be transported uninjured. Anyone who has watched birds feeding from a superabundant supply will have noticed that a considerable number of seeds slip and drop uninjured, the bird not taking the trouble to search for them while there are plenty more on the bush. Thus probably are ivy berries dropped at the foot of the surrounding trees and walls on which the birds perch.

The ivy is therefore a plant which will always tend to occur abundantly as far north as the climate will permit it, for the further it travels north the less the competition from other plants, and the greater the competition of the insects and birds for its favours.

The butcher's broom--that singular exotic-looking plant whose flowers seem to be unvisited by any insect, and whose conspicuous scarlet berries are apparently untouched by any of our native birds—is also now in bloom. But most of our other winter-flowering plants are only exceptional individuals of various hardy species, which can flower wherever and whenever a sheltered nook or glimpse of sunshine can be found.

Tea.

There are various ways of preparing and using the leaves of the tea-plant (*Camellia theifera*). In the *Kew Bulletin* for October Mr. Stringer, Acting Vice-Consul at Chiengmai, describes the mode in vogue among the Laos of Upper Siam. The preparation is known as "Mieng."

The "Pa mieng," or tea forest visited, was on the north-western slope of the mountain range near Chiengmai, where the trees were growing in abundance and close together. The tea-pickers stated that new plants were obtained from seed. There are four seasons for picking the leaves, the first in the eighth Lao month (April–May), the second in the ninth (May–June), the third in the twelfth (September–October), and the fourth in the second month (November–December). The leaves of the first picking are considered the best; the third and fourth pickings yield smaller crops. The young leaves only are taken, the upper part being nipped off with the fingers so as to leave about a quarter still attached to the tree, as if the whole leaf is picked the young branches die.

The picking is done in the early morning, each handful is tied tightly together as it is gathered, and about mid-day the leaves are steamed. The little bundles are placed in a wooden cylinder 2 feet long by 15 inches diameter, at the bottom of which is a network of strips of bamboo. The cylinder is hung over an earthen pot or chatty holding water, and heated over a furnace which consists of a hole in the ground. A wet cloth is placed round the edge of the pot, so that all the steam goes up through the cylinder. When thoroughly steamed it is left to cool, and then taken out and re-tied, and the "Mieng" is ready for use. If, however, it is to be kept for any length of time, it is well trodden down in small pits dug in the ground, and lined with large leaves, to press out as much of the liquor as possible. It is then covered with leaves, and large stones are put on top, and it is kept thus buried for fifteen days. "Mieng" thus prepared is said to last for two years. If wanted for immediate consumption, it need not be buried, but is packed in large baskets, and heavy stones put on it to press out the liquor. The dark reddish-brown liquor left in the pot after steaming is used as food by the Laos and Siamese. The habit of chewing "Mieng" is almost universal among

the Laos; a quid of it seems indispensable for men engaged in hard work such as poling or rowing.

The price of the prepared article at the village visited was one rupee (1s. 3d.) for twelve packages, a package containing ten bundles or handfuls. In Chiengmai it was dearer, seven to ten packages being sold for the same money.

Animals once supposed to be extinct are still being discovered in Australia, the refuge for so many ancient forms of life. The latest announcement is the fact that all the freshwater herrings observed by Mr. Ogilby in certain rivers of New South Wales are doubly armoured, *i.e.*, they have a row of scutes on the back resembling the ordinary armature on the ventral border. In the last number of the *Ann. Mag. Nat. Hist.* (ser. 6, vol. x., p. 413), Mr. Smith Woodward points out that this is a peculiarity exhibited by most of the extinct herrings of the latter part of the Cretaceous and the early part of the Tertiary period. They are assigned to the genus *Diplomystus*, and have been found fossil in Brazil, Wyoming, the Isle of Wight, and Syria. Such herrings do not appear to have hitherto been detected in any part of the world in rocks of later date than the Oligocene, and Mr. Ogilby's discovery in the freshwaters of New South Wales is thus of great interest.

We are glad to find that there are still some anatomists who read Sir Richard Owen's works. In the *American Naturalist* for November, Professor Victor Carus points out that Owen described the cervical vertebræ in *Ornithorhynchus* as having no zygapophyses, while in *Echidna* only the atlas has these processes. The reason for the Professor's letter is that Dr. Georg Baur has recorded this observation as new (*Amer. Nat.*, 1892, p. 72), and commented on the fact that Flower and Lydekker have not noticed it. There are fashions in "authorities" as in more commonplace affairs, and the time will yet come when the great pioneers in Natural Science are duly respected.

In the November number of the *Ann. and Mag. Nat. Hist.*, the Rev. F. O. Pickard Cambridge describes two new forms of British Spiders. The one, *Tmeticus simplex*, was found in abundance in a damp cellar at Cannock, Staffordshire, and the other, *Leptyphantes plumiger*, most probably came from Hyde Bog, near Wareham, Dorset. Figures of both species are given.

A brief memoir of the late Thomas Roberts appeared in Natural Science for March (p. 76). We have now the satisfaction to announce that the Essay on "The Jurassic Rocks of the Neighbourhood of Cambridge," for which he gained the Sedgwick Prize in

1886, has just been published (Cambridge: C. J. Clay & Sons, price 3s. 6d.). This Essay gives a very full account of the Oxford Clay, the Corallian Rocks, and the Kimmeridge Clay of Cambridgeshire and Huntingdonshire. The beds are compared also with their equivalents in other parts of England and on the Continent. The great value of this work results from the care with which the various palæontological horizons have been worked out, so that the lists of fossils and other particulars will be of great service to workers in Jurassic geology.

Those of our readers who have from time to time read with interest reports of the researches of Dr. F. A. Forel on the Lake of Geneva—researches dealing not merely with the geographical details, but with every problem of its physical history—will be interested to hear that he has now collected and issued in book form the results of his labours for upwards of fifty years. The book, of which volume I. has quite recently been issued, is entitled "Lac Leman, Monographie Limnologique," a term which Dr. Forel explains to be equivalent to oceanography, and which he has coined for use when speaking of fresh-waters. The work is illustrated with numerous charts and maps. Dr. Forel cannot believe that the basin of the Lake of Geneva was excavated by the old Rhone glacier: he thinks it is merely an ordinary valley affected by earth-movements.

M. J. Girard, in the *Revue de Géographie* for October, concludes his series of interesting papers, entitled "Études de géographie littorale." In his first paper (August) he treated of "The Movements of Sands," and showed the changes constantly taking place in bays and harbours. He alludes to the effect of small island obstructions in shifting currents and thereby altering sandbanks. In his second paper, "The Genesis of Deltas," the examples are drawn from the Rhone, the Mississippi, and the Hoang-Ho, and two very interesting plans are given of the Rhone delta. In the third and concluding paper M. Girard deals with "Fjords and the Glacial Epoch," and again illustrates his remarks with plans and pictures which are pleasantly new to the reader, not the well-worn figures one is so accustomed to see.

In the *Naturwissenschaftliche Wochenschrift* for November 6, Professor A. Nehring describes the fruit of an extinct plant found in certain peaty deposits at Klinge, near Cottbus. This "sausage-shaped" fruit he names *Paradoxocarpus carinatus;* it will be of interest to English botanists, for the same plant occurs in the Cromer Forest-bed. The other plants found at Klinge are all, with the exception of *Cratopleura helvetica*, common species living in Germany at the present day.

BLACK Burmese rice, according to Professor Church's analysis, published in the *Kew Bulletin*, is unusually rich in the flesh-forming albuminoids and in oil. Compared with other Indian rices, the percentage of true albuminoid in the Black Burmese is as 8·5 to 6·7, while the percentage of oil reaches 2·2 as compared with ·6, the average of the other Indian forms. The nutrient value of the Burmese rice is greater, and is much nearer to that of a complete food than is the case with the common kinds of Indian rice, which are also rather poorer in phosphoric acid. The dark appearance of the grain is due to a pigment contained in the integument, which proves to be identical with that to which is ascribed the red colour of grapes, black currants, the florets of the crimson dahlia, the leaves of the copper beech, and many other leaves, flowers, and fruits. If a few grains of the black rice are covered with slightly acidulated spirits of wine, the pigment dissolves with a magnificent crimson colour.

A NEW mineral named Geikielite, in compliment to Sir Archibald Geikie, has lately been described before the Mineralogical Society by Mr. Allan Dick. In composition the mineral is a magnesian titanite, and it was brought from Rakwana, in Ceylon, by Mr. J. Baddeley. It was found in the form of a pebble, and was taken, with a number of other pebbles, to the Museum at Jermyn Street, and submitted to Mr. A. Pringle for examination. The particular specimen, now named Geikielite, was found by Mr. Pringle to differ in specific gravity and other "external characters" from any known mineral, and it was consequently handed to Mr. Dick for chemical investigation.

Among the store of pebbles collected by Mr. Baddeley, another new mineral was afterwards recognised by Mr. L. Fletcher, and this (as he announces in *Nature* for October 27) proves to be crystallised zirconia. He proposes for it the name of Baddeleyite, as the natural occurrence of this oxide of zirconium has not previously been noticed.

THE "Dictionary of National Biography," of which the first volume was published in 1885, has now reached the thirty-second volume, and the noteworthy men and women have been recorded as far as Leigh. In the volume last issued (1892) we note that there are, among many others, short memoirs of Daniel Lambert, Edwin Lankester, Dionysius Lardner, R. G. Latham, John Lee (of Hartwell), and John Edward Lee. In glancing through the previous thirty-one volumes, we come to the conclusion that the work has been very thoroughly done; and that very few names of any importance will be found wanting. We miss, indeed, a reference to Captain Thomas Brown (the well-known Conchologist); no mention is made of John Billingsley (of Agricultural fame), or of C. R. Bone, a lithographic artist (of Palæontographical fame), but a reference to these omissions will perhaps serve to indicate the general completeness

of the work. Commenced under the editorship of Mr. Leslie Stephen, this great work is now under the direction of Mr. Sidney Lee, aided by a large number of contributors; and it is calculated that the series will be completed in about 50 volumes. Up to the present time the volumes have appeared at quarterly intervals with unbroken punctuality; and the completed work will, it is estimated, contain at least thirty thousand articles. Lists of the names intended to appear are inserted from time to time in the *Athenæum*, so that the Editors have spared no pains to render their undertaking as complete as possible.

Islington, although the most thickly-populated parish in the United Kingdom, remains far behind many smaller parishes and provincial towns in the matter of educational institutions. It possesses no Free Library, no Public Museum, and no Technical Institute. Efforts, however, are being made to establish a Northern Polytechnic Institute, and a meeting was held on November 10, in the Highbury Athenæum, to further the project. The Charity Commissioners have promised an endowment of £1,500 per annum, and the Trustees of the Parochial Charities a further sum of £500 per annum; but these endowments, for maintenance, will not of course be paid until the buildings are erected. A freehold site of nearly two acres has been acquired near the Holloway railway-station, and upon this site it is proposed to erect a large hall, to be available for lectures, concerts, meetings, industrial exhibitions, &c.; a gymnasium, museum, club-rooms, library and reading-rooms, class-rooms, laboratory and workshops. To complete the work £15,000 is still wanted, but surely so important a parish will not be content to remain any longer "behind the times," and will heartily contribute the sum, which amounts to less than a shilling per head of the population.

There are some excellent cautions from the pen of Mr. W. F. Kirby in *Science* for October 28 on "Type-specimens," and "Type-figures" in Entomology. Mr. Kirby points out the difficulties to be encountered in identifying the specimen on which the original description was based, and remarks on the probability of the replacement of a damaged type by a better specimen, not always of the same species. The possible interchange of labels, so likely to occur in the insecta, where labels must always be more or less loose and unfixed, is also referred to, and some words of praise for the general accuracy of Fabricius' work close a too brief article.

Apropos of Mr. Britten's article in the October number of Natural Science, those who wish to follow the subject further may be glad to know that Botanical Nomenclature formed the principal

topic of the meeting of the Biological Society of Washington on October 22. Three papers were read and will no doubt soon appear in the publication of the Society:—The present status of Botanical Nomenclature, by F. C. Coville; Report on the Botanical Congress at Genoa, by George Vasey; and some Controversial Points in Botanical Nomenclature, by George B. Sudworth.

We are sorry to have to include our sparkling contemporary, *The Idler*, among the curiosities of journalism incautiously handling scientific subjects. In the November number (p. 381) the Huckleberry Finn rattlesnake story is revived, the scene being laid in India. Unfortunately, the author has either misunderstood his artist, or the artist has been jesting at the author; for while Mr. Jerome has used a python as his murderous subject, the artist has carefully drawn a cobra, which bites, but does not constrict. The confusion between the picture and the text is most amusing to anyone acquainted with the rudiments of natural history.

We have had many of these sad examples of popular science lately, but a recently-started boys' paper contains one which is calculated to make one ask whether cheap Natural History be not a failure, and popularising played out. For when "a lover of animals" "saunters" round the Zoo, and in one short page hopelessly mixes the hippopotamus and rhinoceros, and speaks in terms of warm admiration of the "otter's" skill in felling trees, one pities the unfortunate boys who are expected to be elevated and instructed thereby. A little more confusion of dentitions and they will think that that of the Primates is calculated pre-eminently for attack, and settle their differences with fangs instead of fisticuffs.

Professor Valentine Ball, of the Science and Art Museum, Dublin, is preparing for publication a map showing the distribution of the fossil mammalia in Ireland.

An excellent portrait of the Rev. Octavius Pickard Cambridge, F.R.S., appears in the November number of the *British Naturalist*.

There are at present to be seen in the Western Aviary at the Zoological Gardens a pair of doves (*Macropygia*) which are interesting from the point of view of mimicry. Their brown-and-black-barred plumage, long graduated tails, and short legs, with a tendency to fulness of feather on the thigh, immediately suggest a cuckoo; only it is very difficult to see what could cause a cuckoo to mimic a dove, or *vice versâ*.

I.

Further Observations on the Permanence of Oceans and Continents.

I.

THE literature relating to the much-debated permanence of ocean basins increases fast, and two fresh contributions have lately been made to it. In the *American Journal of Science* for September (vol. xliv., p. 183), Mr. McGee writes on "The Gulf of Mexico as a Measure of Isostasy"; while in the *Quarterly Journal of the Geological Society* for November (vol. xlviii., p. 519) Mr. R. J. Lechmere Guppy treats of "The Tertiary Microzoic Formations of Trinidad, West Indies." The authors, however, approach the subject from totally different points of view, and it may be of interest to compare their results. The subject is an interesting one, but the unbiased geologist will be much perplexed with the conflicting opinions expressed by the various authorities.

Mr. McGee starts on the assumption that the earth's surface is in a state of nearly stable equilibrium—hydrostatic equilibrium he calls it, but we do not like the term to be applied to so imperfect a fluid as the earth's crust. This equilibrium is indicated by the fact that the crust is densest under the sea and lightest under mountain ranges; therefore, as long as there is no transfer of matter from place to place the dense sea-bottom will balance the lighter mountains. Rivers, however, gradually transfer the land to the bottom of the sea; consequently the loaded sea-bottom will continually subside, perhaps carrying with it the adjacent flat shore, while the unloaded continental areas will slowly rise.

As an abstract proposition no fault can be found with this argument; but no quantitative measurements of the earth's density sufficient to prove any near approach to a hydrostatic equilibrium have yet been made. When, also, Mr. McGee points to estuary after estuary as showing recent subsidence, we cannot help observing that he does not always clearly distinguish between loss of land from marine erosion and true subsidence. He also makes no allowance for the slow compression that estuarine deposits are always undergoing, as the organic matter decays and the particles pack closer. The historical evidence for the post-Roman subsidence in Holland is

scarcely satisfactory, and sand-dunes do not necessarily indicate subsidence. So much of Mr. McGee's paper is taken up with the attempt to strengthen his case by the appeal to evidence of doubtful value, that we cannot ignore it; the Gulf of Mexico, however, is the region with which he is primarily concerned. To that area we will now turn.

The Gulf of Mexico is a nearly land-locked sea, which receives the detritus brought by the Mississippi and other rivers and derived from the erosion of about half the North American continent. This detritus, however, is nearly all deposited in the northern half of the Gulf, so the area of degradation is about 6½ times the area of deposition. If the theory be correct, that the rise or fall of an area depends on the weight removed or piled upon it, then the continent of North America must be a rising area, and the northern half of the Gulf of Mexico a subsiding one.

Such is probably the case, but there is some danger of confusion between cause and effect. It is quite as logical to argue that the land is denuded because it rises, as that it rises because it is denuded. We may also observe that if from any cause the land sinks beneath the sea-level, the part that subsides most rapidly necessarily becomes first a bay and then probably an estuary, for river-valleys will tend also to follow lines of depression. Suppose, on the other hand, that the floor of the Gulf of Mexico were to rise; the Mississippi would discharge further to the east, beyond the West Indies, and we should be told that the depression beyond was caused by the accumulation of sediment. Unless the theory of stable equilibrium be of merely local application, it is difficult to understand how land once beneath the sea-level can ever rise again; yet we know that extensive marine deposits often occur high above the present sea-level.

Mr. Guppy, writing of a district similar in many respects to that dealt with by Mr. McGee, treats the subject from a point of view altogether different. He is concerned mainly with the geological and biological evidence, which go to indicate that what is now dry land was once a deep sea, and the facts relied on are these:—Trinidad possesses in its southern half certain Tertiary formations, which from the character of their fauna seem to indicate a depth of at least 1,000 fathoms. These deep-water deposits are absent from surrounding areas; and from their partial occurrence, combined with the evidence obtained from the geology of the surrounding islands and coast of South America, Mr. Guppy arrives at these conclusions. During the Cretaceous and Eocene periods there was a sea having a depth of 1,000 fathoms or more in the area now occupied by the microzoic rocks of Trinidad. During the same period the northern mountains formed probably an unbroken range with the littoral Cordillera of Venezuela, and constituted the southern boundary of a Caribbean Continent. These mountains may be regarded as one of those "stable areas" which have never been submerged since Palæozoic

times. The Orinoco was then in existence, but brought no appreciable sediment so far from what was then the mouth of the river.

The Orinoco seems, therefore, to have discharged its sediment into a land-locked sea greatly resembling the existing Gulf of Mexico. If Mr. Guppy's account of the geology be correct, the estuary of the Orinoco and the Gulf of Paria ought, on the theory adopted by Mr. McGee, to have formed a subsiding area ever since early Tertiary times, for it is over that area that the sediment has been deposited. Such may have been the case, though we have as yet no direct evidence of the fact. When, however, we read that the southern half of Trinidad is occupied by deposits formed at the great depth of 1,000 fathoms, while the northern half has never been submerged since Palæozoic times, it is not easy to reconcile this rise of the sea-bottom with Mr. McGee's theory.

The views of Messrs. McGee and Guppy, as we remarked, have only quite lately been propounded. If we refer to literature a little earlier, however, there are numerous papers by other authors with a direct bearing on the same subject; and we may allude especially to four papers by Professor James D. Dana,[1] in which the permanence of the continental area of North America since the beginning of Palæozoic times, at least, seems to be satisfactorily proved. "The facts illustrate strikingly the great truth that the earth's features, even to many minor details, were defined in Archæan time, and, consequently, that Archæan conditions exercised a special and even detailed control over future continental growth. The extension of North America to the most eastern point of Newfoundland, and beyond it, was determined in this beginning time; and likewise, that of the European Continent to the Hebrides, in front of the Scandinavian Archæan area." The main result is briefly summed up by Professor Dana in the following letter, while Dr. Blanford and Mr. Jukes-Browne add some further comments from their point of view.

II.

With regard to the discussion on the Permanence of Oceans and Continents now proceeding in Natural Science, I may say that the argument from North America is brief: that the successive formations, from the Archæan onward, follow one another quite regularly over the surface that lies outside of the northern Archæan area, and bear

[1] "Areas of Continental Progress in North America, and the Influence of the Conditions of these Areas on the work carried forward within them," *Bull. Geol. Soc. America*, vol. i., 1889, pp. 36–48.

"Archæan Axes of Eastern North America," *Amer. Journ. Sci.*, vol. xxxix., pp. 378–383, 1890.

"Rocky Mountain Protaxis and the Post-Cretaceous Mountain-making along its Course," *ibid.*, vol xl., pp. 181–196, 1890.

"On Subdivisions in Archæan History," *ibid.*, vol xliii., pp. 455 462, 1892.

evidence throughout of shallow water origin; and that in this way the continent was extended from the Archæan southward, south-eastward, and south-westward.

The evidence as far as the eastern half of the continent is concerned was clearly manfest before 1845 (my first paper on the origin of continents was published in 1846 in the *American Journ. Sci.*, 2nd ser., vol. ii.), by which time the States of Connecticut, Massachusetts and New York had been geologically surveyed, and their final reports published, including a general coloured geological chart of the country by James Hall; and, besides, incomplete surveys had also been made of some other States. Further, the Professors W. B. and H. D. Rogers had so far completed the surveys of Pennsylvania and Virginia that they brought out in 1842 (*Trans. Assoc. Amer. Geol. and Naturalists*) their admirable paper on the Appalachian Mountain system, their flexures, &c. They showed that the flexing, faulting and uplifting for the 1,000 miles of their length was a sequel to the long series of Palæozoic deposition, a folding of the strata from the bottom (the Cambrian, as now called) to the top, confirming all other evidence that the strata were continental formations, and the work, regular continental growth.

Afterwards the earlier Mesozoic (that is, the Jura-Trias), added only brackish water or fresh-water beds, along some portions of the Atlantic border; and later the Cretaceous and Tertiary followed, finishing the continent to its eastern limit.

Similar facts complete the argument for continental permanence as regards the western half. By permanence, as I have always said, is meant, not the absence of deep subsidences, or of deep continental waters at times—say 2,000 or 3,000 feet in the interior, or on the borders, but the non-occurrence of oceanic depths and alternations with oceanic conditions.

JAMES D. DANA.

New Haven, Oct. 14, 1892.

III.

I DO not wish to continue the discussion on this subject, but I think that Dr Wallace has not, in two instances at least, in his letter published in the November number of NATURAL SCIENCE, quite understood my arguments.

Dr. Wallace states that he cannot understand why the connection between Africa and India by means of existing continental areas would not suffice for the explanation of certain relations between the faunas and floras of India and the Mascarene Islands, and why I should prefer to bridge an ocean between 2,000 and 3,000 fathoms deep, in order to reduce the distance slightly. I may say that I do not regard the question of distance as material; and the majority

of the assumed zoological and botanical migrations, though not all, might have taken place equally well by either route, but the geological evidence appears to me only consistent with the former existence of a belt of land across what is now in places deep sea.

This geological evidence is, briefly: (1) That South Africa, India, and Australia, in late Palæozoic and early Mesozoic times, formed parts of one continental area, and that this area was separated by a wide sea, probably of considerable depth, from Northern Asia, Europe, and North America, which were also connected by land; (2) that in Cretaceous times part of Western India, a little north of Bombay, and also the South Coast of Arabia, were part of a sea that extended over a wide area in South-western Asia and in Europe, and that the Khasi Hills in North-eastern India, Trichinopoly, south of Madras, and Natal, in South Africa, were on the shores of another sea, divided from the first by a land barrier; (3) that, as shown by Neumayr, there are indications of this same land barrier in Jurassic and Neocomian times. I do not see how these facts can be explained by land connections within the present 1,000-fathom limit, and as it has been shown that a depression of part of the old barrier, the Mozambique Channel, to a depth of upwards of 1,000 fathoms, has taken place within comparatively recent times, almost certainly since the Miocene, and probably since the Pliocene period, it is not improbable that another part of the old barrier may have undergone depression to a greater depth, even to 2,000 or 3,000 fathoms in places, since the Cretaceous or Eocene. It must not be forgotten that the connecting barrier, which I believe to have once existed, is represented by a tract of ocean still dotted over with islands and shoals; that the soundings are far from sufficient to show the true contour of the ocean basin; and that there is, so far as I am aware, no geological or biological indication of probable land connection in Palæozoic or Mesozoic times in the direction preferred by Dr. Wallace.

The other point is of no great importance. Dr. Wallace says that my suggestion of a possible Mesozoic girdle of land, chiefly in low latitudes, from Peru to New Zealand and the Fiji Islands is inconsistent with the permanence of the great ocean basin of the Pacific. He must, I think, have overlooked the circumstance that the supposed girdle in question was explained as passing through Australia, India, Madagascar and Africa, and not across the Pacific Ocean (*Proc. Geol. Soc.* 1890, p. 106).

The real difference between Dr. Wallace's views and mine is, I think, this, that Dr. Wallace regards ocean permanence as an established law, only to be disregarded on the clearest evidence, while I look upon it as a theory supported by some important and valuable data, but by no means proved; and I contend that there is ample proof that even if the law of permanence prevails it is not universal. As a result of this, I think that every questionable case must be judged upon its merits, and if the evidence tends to show that land formerly

existed where deep sea is now, or *vice versâ*, that evidence must not be summarily dismissed because it is opposed to a theory that, as it appears to me, is very far from being satisfactorily established.

W. T. BLANFORD.

IV.

PERMIT me to explain the passage in my article on this subject which Dr. Wallace characterises as "an extraordinary claim." When I wrote that "the present continents are the outcome of a long series of mutations," each phase being "an episode in a long process of geographical evolution," I had in my mind a very different kind of evolution from that assumed by Dana with respect to North America. He regards the surface exposure of the Pre-cambrian rocks in Canada as the nucleus of the continent, and believes North America to have been built up by additions to this nucleus. In the case of America, there does seem to have been a process of building up by additions during Neozoic times; but I maintain that neither America nor any other continent dates back as a distinct continental plateau to Palæozoic times.

The evolution I referred to was the gradual evolution of continents and oceans together out of a more generalised state of geography. I look back to a time when the physical features of the earth's surface were less accentuated than they are now; when there were neither oceans nor continents, but a more equal distribution of land and sea all over the globe.

I cannot see that Dr. Wallace's argument about the relative displacement-capacity of continental masses and oceanic waters proves the continents to have maintained the same positions from the earliest times. Dr. Wallace evidently fails to see the force of my reply; all his argument proves is that, *if the volume of water has been always the same*, the total area of land at any period cannot have been much larger than it is now, but in my article I showed that it was unsafe to assume that the volume of ocean water is a constant quantity.

Again, what does Dr. Wallace mean by the great ocean-basins? and why does he object to the view that the Dolphin Ridge has once been land? To me it does not seem rational to speak of the Atlantic as a single *ocean-basin*; it is distinctly a double basin, and I can see no reason why a large part of the Dolphin Bank should not have been land, say in Triassic or Permian times.

Dr. Wallace must remember that the geologist deals with a length of time that reaches back far beyond the age of the modern genera and families of terrestrial animals, and even if the distribution of such animals can be explained by means of comparatively small geographical changes, it is because most of these families do not date

back beyond the beginning of Tertiary times, and are no guide whatever to the geography of Palæozoic times. Geologists must claim a free hand to draw conclusions from the geological evidence as regards Pre-tertiary epochs untrammelled by any inferences derived from the distribution of modern animals.

On the subject of oceanic islands I shall have something to say elsewhere.

A. J. Jukes-Browne.

II.

An Evolutionist in East Africa.

IT was the late Richard Jefferies, I think, who said that one of the greatest charms of Gilbert White was that he had no theory: he was not full, while he observed, of evolution, degeneration, and the like. Yet under the present circumstances, it is hardly possible to observe at all without ultimately testing the bearing of some of one's observations on the problems that constantly agitate biology, and during my recent short stay in East Africa I came across some facts which seemed to me worthy of record in this connection.

Shakespeare has observed "how use doth breed a habit in a man"; and certain observations I was enabled to make during my voyage out would seem to suggest that it has a similar effect upon lower bipeds. When arriving on board, the ship's ducks looked miserable enough to give rise to a proverb; they were unclean, and had not yet accommodated themselves to the resting-place afforded by the raised barred floor of their coop. Their squalor disappeared by washing pretty frequently; and before the end of the voyage, I noticed that when they were let loose on deck after this operation several of them, being so used by this time to perching, selected anything handy, like a rope or a pipe, as a standing-place. On reaching Zanzibar, I had a further instance of the versatility of the mallard. Domesticated here, in a climate unnatural to it, and where almost all the water accessible is extremely salt, this bird has adopted terrestrial habits, and runs actively about on the mud of a tidal swamp under a tropical sun at mid-day, retreating from the water instead of taking refuge in it when approached. Even on the sandy ground among the huts where there was no sea-water, these ducks appeared comfortable and healthy enough, so that it is quite possible that *Anas boschas* will supplant the Muscovy duck (*Cairina moschata*), the usual domestic duck on this coast, which is naturally less aquatic and a tropical bird. What modification may take place in consequence of this change of habit should be an interesting question. All that can be said at present is that the Zanzibar mallard seems, if anything, slighter and more erect than the European domestic duck, and that the males were, in the first week in August, mostly in full plumage in Zanzibar, while at home at that time one might vainly seek in fen or farmyard for a drake in complete

masculine attire. The Muscovy duck itself varies somewhat from the type we are accustomed to in England. I have seen specimens with the bare red face enormously developed into warty caruncles rising on each side over the eye above the level of the crown, like the eye wattle of a Barb pigeon, and extending to the base of the lower mandible. Yet others, apparently adult, had the red confined to a small area at the base of the beak, and showing little, if at all, round the eyes. With these there were specimens with an average development of red skin, so that the variation in such different directions is difficult to account for.

The fowls met with were equally interesting. In Naples, at Port Said and Suez, and in East Africa, they showed signs of complete panmixis in the various colours they displayed; yet the form and comb were in every case characteristic, suggesting forcibly that many of our breeds have in the first instance made themselves, as it were. In Naples, most of the hens to be seen about the street were of the Leghorn and Minorca type, carrying, whatever their colour, a large "single" comb, lopping over to one side. The fowls from Port Said and Suez were barely of the size of Hamburgs, meagre and skinny, with erect tails, and combs which were bifid either posteriorly or altogether, while of moderate size. The hind toe in these fowls was also often bifid. In Zanzibar the prevalent breed of fowl was the Malay, tall and gaunt, with a neck so closely feathered as to suggest, in the hens, a heron's, and the comb small in the cock and a mere rudiment in the hen. Elsewhere on the African coast there are fowls quite European in type, except for the hens' rudimentary combs; I therefore think the Malays are of Indian origin. A very ridiculous-looking variety which occasionally occurred, has the long neck of the ordinary breed without the long legs, these members being unusually short. Tailless fowls were common, but the tail seemed to be merely very short or soft, the feathers being defective, not the caudal vertebræ, as in the rumpless breed. Frizzled specimens, with the feathers reversed, might also be seen. The fowls appear to be very scantily fed, and no doubt become somewhat predaceous, as I saw one carrying off a snake about its own length, dead, and so mangled as to be useless as a specimen. With the freedom of breeding that exists among the poultry here, one would expect reversion, but as a matter of fact the colour of *Gallus bankiva* is not by any means that most commonly seen.

The goats are as interesting as the poultry, on account of the great variety in colour and form they exhibit. Some are extremely antelopine in colour and markings; and as to form, I once saw white specimens with a head and neck so gazelle-like, that I at first mistook one for an albino gazelle. On board the "Juba" there was one of the smooth-haired African sheep, which in its close brown coat also recalled an antelope. A collection of the horns of the Zanzibar goats

could not fail to be instructive, as exemplifying the variations of a domestic species, since they present astonishing differences. The pariah dogs of this coast much resemble a smooth-coated Dingo which once lived in the Zoological Society's Gardens, but they are smaller. The normal colour appears to be yellow, but others occur; I have seen partially drooped ears and a curled tail, but, of course, mixture with European dogs now and then occurs.

A common pet with the Swahilis is a small turtle-dove (*Turtur damarensis*) which presents an interesting instance of commencing divergence. All the Zanzibar specimens of this bird noticed had a black line from the bill to the eye, usually wanting, or not readily perceptible, in Mombasa specimens. The Zanzibar specimens, too, of the frog *Xenopus lævis* are largely yellow on the under side of the thighs—a character which is not apparent in Cape specimens in the Zoological Gardens.

This curious frog is very common in Zanzibar, inhabiting the small and shallow wells whence the natives procure water, and presumably subsisting on insects which fall in. It is usually seen in the water with its head out, but I have seen them just at the edge, on the mud. On land they move along in jerks rather than hop, and this possibly explains the presence of claws in so aquatic a species. I gave a specimen of this frog to a mongoose (*Crossarchus fasciatus*) and the animal mortally wounded and left it. Next day, however, it killed outright and partly ate another specimen, which appeared to be distasteful when bitten, and was soon vomited. This latter incident also happened with a lizard (*Mabuia striata*) which the mongoose had had the day before, but the lizard was, nevertheless, entirely eaten. This mongoose, curiously enough, appeared to be unwilling to attack birds, though it did not seem to find them unpalatable. The lizard above mentioned is extremely common both in Zanzibar and Mombasa, though it appeared to me wilder and more difficult to capture in the latter locality. In Zanzibar its great haunt is the wall of an old burial-ground, just outside the town, in the crevices of which they retire to rest, and can be gently drawn out by the tail, if caution be used to prevent its breaking; this calamity often happens, though the tail appears much less brittle in *Mabuia* than in *Lacerta vivipara*, in which it parts with the slightest struggle. A gecko (*Hemidactylus mabuia*) was also very common in Zanzibar, and I was able, both in that town and in Mombasa, to carry out some more experiments with regard to the palatability of various animals, both with *Mabuia* and *Hemidactylus*, specimens of which I had in captivity. In the back yard of the hotel grew some castor-oil plants, infested by a large number of black-and-yellow, sparsely haired caterpillars, which were greedily devoured by one or two glossy cuckoos. These larvæ ultimately developed into a moth (probably an *Euproctis*) almost exactly resembling *Porthesia auriflua*. These moths were readily eaten by the geckos, though

refused by fowls. I offered the geckos some "fireflies" (a small luminous beetle, not an *Elater*) which, though examined, were not eaten, so far as I saw. At Mombasa I offered my geckos two moths closely resembling the Buff Ermine, and presumably of the same genus. One was seized, and it did not appear to be rejected. A glossy-black *Blaps*-like beetle was not touched either by chamæleon or gecko, nor was the moth *Egybolia vaillantina*, a specimen of which I knocked down and gave to them. This moth is dark metallic blue, marked slightly with yellow, and looks black and very conspicuous in its slow heavy flight. The chamæleons on this occasion were probably not feeding, and I shortly afterwards found the moth dead—possibly injured in its capture. Wood-lice also were not touched by my small lizards, though *Gerrhosaurus major*, of which I had living specimens, readily ate a large *Armadillo*. Yet I once saw one chewed and rejected by one of these large lizards. Both geckos and a *Mabuia* seized and refused a red, black-legged Hemipteron common at Mombasa. The large milliped *Spirobolus*, already mentioned in NATURAL SCIENCE, is common near Mombasa, and Dr. Baxter of the Mission informed me that the odour it emitted when attacked by a mongoose was so pungent as not only to baffle this enemy, but to make his eyes smart as he stood by. A specimen procured at Wasin was offered to my own mongoose, which refused to attack it. As this milliped is dead black, with red legs and antennæ, it would appear to be a good instance of warning coloration. On offering the large dark-brown species, *Spirostreptus gigas*, to a *Galago* which readily ate grasshoppers, however, it was untouched. Possibly, therefore, this also is unpalatable, though not marked with warning colours.

I regret that I have not been able to make any noteworthy observations bearing on sexual selection. I once, however, was witness to what Mr. Boulenger thinks was the courtship of two lacertilians, though I interrupted it, under the impression that it was a fight, by attempting to catch them as they circled round and round with their heads down and tails up, occasionally closing, biting, and rolling over. The species was *Mabuia striata*, which, though handsome above, is quite plain beneath. One is at first very much tempted to put down to sexual coloration the red patches at the back of the thigh which are found in the toad, *Bufo regularis*, in this locality, and about the same region and under the arms in a tree-frog, *Hylambates maculatus* As these tints are concealed when the animal is in its normal squatting position, one naturally thinks of some special reason for their existence. Mr. Boulenger considers that they cannot be sexual, as they exist in both sexes, and as the pairing in the Anura is not calculated for the display of beauty on the part of the animals. The tendency to red marking in widely-separated genera of Anura in certain local areas is also exemplified in the Malay Archipelago[1]; in a collection

[1] *See* Boulenger, P.Z.S., 1890, pp. 31–40.

containing 12 species from Sumatra, Mr. Boulenger found no less than half marked with carmine, while a similar proportion obtained in a collection from Malacca.

Of the Oligochaete worms, the objects of my expedition, I have little to say. The dry sandy character of the East African soil is not suited for these animals (though it must be remembered that I was there in the dry season), and they only occur round pools, or in similar damp situations, as where water from houses has been constantly poured. The earthworms are prevailingly "thin and hungerly" in appearance, and of smallish size. I found numbers of a bluish earthworm in a bog on the mainland not far from Mombasa, in mud so wet that the water ran into the hollows made in digging out the worms. Similarly semi-aquatic is a mole-cricket (*Gryllotalpa africana*) which burrows, often in quite wet mud, without contracting a stain, and swims ashore quickly and composedly when thrown into the water. As our own species is an inhabitant of light and dry soils, this tolerance of wet in the African form is curious, and may help to explain its wide distribution, as it occurs in the Ethiopian, Indian, Australian, and even Palæarctic regions.

In conclusion, I must express my thanks to the British Museum officials for their kindness in assisting me to identify many of the animals herein mentioned, and to the residents in East Africa for their hospitality and assistance during my stay among them.

FRANK FINN.

III.

Note on Sexual Selection.

IN Mr. Cunningham's review of Mr. Romanes' new work, "Darwin, and after Darwin,"[1] the writer gives an independent and thoughtful criticism of my views on that subject, and I should like to be permitted to make a few observations in reply thereto. Mr. Cunningham says:—"Mr. Wallace argues as though the superior male, *facile princeps*, in the competition for a living, could found a line of descendants inheriting his own health and vigour, without female assistance." And again: "A male that excels in the struggle for existence is a complete failure, so far as the species is concerned, unless he can succeed also in finding mates." These passages seem to me to involve suppositions against all probability and all evidence. They imply that the better organised male, in all respects, except in ornament, is rejected by the females in favour of the worse organised in every respect, except in ornament. There are here two improbable assumptions—the first, that the most ornament is usually, or frequently, dissociated from the best general organisation; and the second, that any such less perfectly organised male would be preferred by the female on account of his slightly superior ornament. For the difference, it must be always remembered, *is* slight. Out of a hundred male pheasants or peacocks of the same age, the difference in length of plumes or shade of colour is rarely very conspicuous or even perceptible, except by close comparison; and if whatever difference there is were *not* usually associated with vigour and health, then the two forms of sexual selection—by combat and by display of ornament—would lead to different results; and, as males with ornamental appendages usually *do* fight for the females, the most ornamented would *not*, in their case, be the parents of the next generation.

We are, therefore, forced to conclude that the two qualities—general vigour and ornament—*are* not independent of each other, but are developed *pari passu*, and the problem then becomes, does the female determine her choice by the latter rather than by the former? I quite agree with Mr. Cunningham when he says: "The sexual desire of the female has a hereditary association with certain sensory

[1] NATURAL SCIENCE, vol. i., p. 546.

stimuli, and the means of furnishing these stimuli are constantly reproduced and improved by inheritance in the males." I further admit that the display of ornament by the male is one of the means of exciting this desire; but mainly because it is an indication of sex, of sexual maturity, and of sexual vigour, probably not at all on account of details of colour or pattern.

There is, however, another consideration which Mr. Cunningham appears to have overlooked, and that is, the necessary weakness, comparatively, of female selection, owing to the very limited range of her choice. The law of survival of the fittest has such enormous selecting power because of the overwhelming odds against the less fit. A species which has two or three broods a year, or one large brood, and which lives, say, ten or twenty years, as do many of the vertebrata, produces from 50 to 100 successors of each pair, from which one or two only are selected to take the place of their parents. But in the case of sexual selection, it is a question of probably not more than two or three to one in most species, and in many even less, for there is no evidence and little probability that the number of healthy and competent males that fail to find mates bears any large proportion to those that do find them. Much of the success of particular males must depend on early chance encounters with a mate, while the competition can only be among small groups in each locality. If we add to this the consideration that in almost every case combat, or agility, or bodily vigour must have great influence, the part that remains to be played by ornament alone will be very small, even if it were proved, which it is not, that a slight superiority in ornament alone usually determines the choice of a mate.

This, however, is a matter that admits of experiment, and I would suggest that either some Zoological Society or any person having the means, should try such experiments. A dozen male birds of the same age—domestic fowls, common pheasants, or gold pheasants, for instance—should be chosen, all known to be acceptable to the hen birds. Half of these should have one or two tail plumes cut off, or the neck plumes a little shortened, just enough to produce such a difference as occurs by variation in nature, but not enough to disfigure the bird, and then observe whether the hens take any notice of the deficiency, and whether they uniformly reject the less ornamented males. Such experiments, carefully made and judiciously varied for a few seasons, would give most valuable information on this interesting question. Till this is done, suppositions as to what determines the choice of the female can have but little value.

ALFRED R. WALLACE.

IV.

An Advance in our Knowledge of Seedlings.[1]

THE study of the germination of seeds and the resulting seedlings is not a new one. In 1693, Homberg, in the Memoirs of the Paris Royal Academy of Science, published his "Expériences sur la Germination des Plantes," and from that time to the present day there has been accumulating a large amount of literature in the publications of the various Scientific Societies, and also in the form of treatises dealing with individuals, groups, or some special aspect of the subject. It was not till the beginning of the present century that much attention was given to the early stages of a plant's history; but then several important works appeared. Mirbel's "Nouvelles Recherches sur les Caractères Anatomiques et Physiologiques qui Distinguent les Plantes Monocotylédones des Plantes Dicotylédones," in the *Ann. Mus. d'Hist. Nat.*, vol. xiii. (1809), contains one hundred and forty figures of seedlings; and this was soon followed by his "Considérations sur la Graine et la Germination." About the same time De Petit Thouars, Poiteau, and L. C. Richard were also busy; the "Analyse Botanique des Embryons Endorhizes ou Monocotylédones et particulièrement de celui des Graminées" (*Ann. Mus. d'Hist. Nat.*, t. xvii. (1811)) of Richard is one of the best accounts and gives very good figures of the germination of grasses. They were closely followed by Tittmann, whose study of the embryo and its development into the plant appeared at Dresden in 1817, and who shortly after produced several other kindred papers. We must not stay to review the copious but often exceedingly fragmentary and very widely-scattered literature of the last seventy years; among the most useful are the numerous papers of Irmisch and Winkler in Germany, and Warming of Copenhagen.

In all this literature, however, we find no satisfactory general account of the whole subject. In 1884 Klebs' "Beiträge zur Morphologie u. Biologie der Keimung" appeared in Pfeffer's "Untersuchungen d. Botan. Institut, Tübingen"; but this deals purely with the process of germination and does not consider the resulting seedlings. Tubeuf,

[1] A Contribution to Our Knowledge of Seedlings. By the Right Hon. Sir John Lubbock, Bart., M.P., F.R.S., &c., &c. London: Kegan Paul, Trench, Trübner & Co., 1892. 8vo. Vol. i., pp. viii. and 608; vol. ii., pp. 646. With 684 figures in the text. Price £1 16s.

in his "Samen, Früchte u. Keimlinge" (Berlin, 1891), describes the seed and seedlings of some of the endemic German shrubs and trees; but up to the present date seeds and seedlings have never been studied in the same systematic way as the adult plants. This deficiency Sir John Lubbock seeks to supply in his "Contribution to Our Knowledge of Seedlings."

The two good-sized volumes contain the results of a vast amount of work. Seeds of almost every natural order have been germinated, and the seeds and seedlings, and process of germination, described. In the case of small orders, or those exclusively tropical and not found in cultivation, it has been possible to give only a few illustrations; but the large and important temperate or world-wide families have been very thoroughly studied. The arrangement adopted is that of Bentham and Hooker's "Genera Plantarum"; preceding the technical descriptions of the plants of each family is a general account of the fruit and seed considered as bearing on the form of the embryo, and also of the seedlings, while an attempt is made at a classification of the chief types.

The systematic portion of the work is prefaced by an introduction of nearly 80 pages, in which the author discusses some of the leading points arising from the subject-matter of the twelve hundred pages which follow. The contents of this introductory chapter have already appeared in several papers published in the Journal of the Linnean Society; they are reproduced here in a revised and connected form.

The introduction shows what to look out for in the rest of the work, and the explanations proferred of the points here briefly touched upon will suggest much to those who read the book with any intelligence, and show, moreover, what a mine of wealth lies hidden in the mass of technical descriptions. The author lays stress on the variety in form of the seed-leaves or cotyledons, which though not quite so great as that obtaining in the foliage, is yet surprising; and also on the striking contrast between the cotyledons and not only the final leaves, but even those by which they are immediately followed. "So far, indeed, are the cotyledons from agreeing with the forms of the leaves, that the difficulty is to find any which have been clearly influenced by them." In some cases, however, it is evident that external conditions acting similarly on both have had a similar result, as, for instance, in the Crassulaceæ, where we find the cotyledons observed were all succulent, like the adult leaves and the plants themselves, those of *Crassula quadrifida* being also similarly covered with glands secreting a white substance; in both cases the same protection against loss of moisture has been adopted.

We may contrast these with the drought-loving cactus family, where, as in *Opuntia*, the cotyledons are fleshy, while the leaves have been reduced to spines or bristles (Fig. 1). In *Echinocactus viridescens* (Fig. 2), however, it is interesting to find the cotyledons also reduced,

forming minute, scarcely elevated green teeth at the junction of the fleshy hypocotyl and stem.

In some of the marsh species of *Ranunculus* the cotyledons are narrow and elongated, like the leaves.

Where the seed contains no endosperm but is filled by the embryo, the shape of the cotyledon must often largely depend on the way in which it is packed, and its relation to the leaves subsequently produced will not be evident; but if we compare cases where the embryo is so embedded in endosperm as to be apparently uninfluenced by the shape of the seeds, and where, moreover, the seed-coat splits widely on germination, allowing a free exit, we may sometimes find some rough resemblance in the relation between the seed-leaves and those of the adult.

Thus, in the Cistineæ, where these conditions hold, two leading types of cotyledons are represented by the two leading genera *Cistus* and *Helianthemum*; in the former they are comparatively narrow, in the latter broad, and the ultimate leaves, at any rate in the case of the species considered, will be found to bear a similar relation, those of *Helianthemum* being the broader. This relation may sometimes be observed also, other conditions being similar, where the seeds are exalbuminous. Thus, two species of *Matthiola* are described, in one of which, *M. incana* (Fig. 3), the cotyledons, the primary and ultimate leaves are respectively broader than in the other, *M. bicornis* (Fig. 4).

Such relations are, however, quite exceptional, and the contrast between the seed-leaf and the ultimate form is certainly striking. Sometimes the adult form is assumed abruptly, as in the cactus family above-mentioned, and this may happen even when the leaf is a highly developed compound one, as in some Leguminosæ, *e.g.*, *Æschynomene aspera* (Fig. 5). Very often, however, in species with compound leaves, the two following the cotyledons are simple and opposite, as in *Indigofera australis* (Fig. 6), the scarlet-runner (*Phaseolus vulgaris*), *Pueraria* (Fig. 7), and other Phaseoleæ. Frequently we find a more or less perfect gradation to the adult form, as in *Ceratocephalus* (Fig. 8) or *Ranunculus arvensis* (Fig. 9).

Where the cotyledons are thick and fleshy, serving merely as a store-house of reserve material for the growing seedlings, and remaining in the seeds usually beneath the ground, the first few leaves are reduced to small scales, as in *Sapindus inæqualis* (Fig. 10). Green assimilating leaves are unnecessary while the store in the seed is inexhausted, and the whole energy of the seedling can be more profitably spent in raising it as high as possible into the light and air, and out of the influence of surrounding vegetation.

In a few rare cases the cotyledons by growth after germination do come to resemble the ordinary foliage leaves. The Onagrarieæ supply most of the examples. The cotyledon at first bears no relation to the subsequent form, but a new growth takes place at its base, so that the whole organ finally resembles in form and appearance the

other leaves of the plant, though still bearing the original cotyledon at its apex. The accompanying figures of a species of *Clarkia* will illustrate this (Fig. 11).

The cotyledons, immediately after germination, are oblong-orbicular, slightly auricled at the base and sessile; they then enlarge and become orbicular or broadly ovate, somewhat cuneate at the base, and shortly petiolate, as seen in Fig. A, which represents a specimen three days after germination. The new basal portion grows as represented in B and C, five and ten days after germination respectively, until it ultimately forms the greater part of the leaf from which it is easily distinguished by its irregular ciliate margin, as seen in D. *Streptocarpus* (Fig. 12) (Gesneraceæ) presents a somewhat similar case, but here one of the cotyledons only shows an extraordinary development, and becomes the first foliage leaf.

In the introduction, the author also discusses the shapes of cotyledons, showing how the length, breadth, symmetry, equality, crenation, emargination, lobing or fission, and presence of auricles may often be explained by their having to be packed into a seed of a given shape or successfully to make their exit from the same in germination. It is, of course, open for one to say that the seed is made to fit the embryo, not the embryo the seed, but, as Sir John points out, the shape of the seed is often largely predetermined by that of the fruit or the way in which they are packed; and, moreover, the devices for distribution or protection against injury by beast or climate must often have had considerable influence. This last consideration is well exemplified in two species of *Galium*. The shape of the seeds is the same, but those of *G. aparine* have only a thin coat, as there are no conditions of extraordinary severity to be endured, while the seeds of *G. saccharatum* are provided with a tough corky coat, to prevent drying up in the hot climate of North Africa. The thin coat of *aparine* will tear easily in germination to allow the exit of the cotyledons, which can therefore broaden out in the endosperm, but the thick coat of *saccharatum* is too tough to be thus easily torn, and the cotyledons therefore remain narrow, so that they can be drawn out through a much smaller opening (Figs. 13 and 14).

Narrow cotyledons are frequently a device for easily getting clear of the seed, thus in Santalaceæ "their narrowness seems to be due to a difficulty of exit from the small opening of the woody fruit, for there is plenty of space inside to allow of their attaining a much greater width," and even then they often become torn in the process. Compare also the acicular cotyledons of the pines (Fig. 15) and firs, which seem to shake off the seed with difficulty. Broad, flattened seeds often contain narrow cotyledons from the fact that the embryo lies transversely, often curving round the edge as in *Menispermum* or many Chenopodiaceæ (Fig. 16) and Amarantaceæ. In the case of the sycamore, the strap-shaped cotyledon can be easily rolled up into a ball and packed in the round seed (Fig. 17).

The walls of the seed are sometimes thickened at the chalaza, or point where the vascular bundles enter the seed-coat, and this may cause a notch in the apex of the seed-leaf; similarly, auricles at the base are explained by the effort of the cotyledon to fill up the space round the radicle. A section of the seed of *Cuphea silenoides* illustrates both these phenomena. In the convolvulus and its tropical allies, the ipomœas, a ridge at the chalaza is sometimes so prominent that the cotyledons cannot grow in length, and are consequently divided almost to the base.

Sometimes, however, as in *Berberis aquifolium*, the cotyledons are notched though lying quite free in the endosperm.

Inequality of the two cotyledons may be due to folding in the seed, as in the radish or cabbage (Fig. 18), where they are applied face to face and then doubled longitudinally; the outer one, having more space, is the larger. In the geranium there is a want of symmetry in each cotyledon, due to one-half of each being folded inside one-half of the other, the two inner halves being the smaller (Fig. 19).

The curiously divided cotyledons of the lime are explained by their manner of growth in the seed, where they meet the wall and then curve back, following its general outline; to fit the walls neatly without crumpling they must be cut into lobes (Fig. 20).

These are only a few of the considerations arising from the descriptions and illustrations, which form the bulk of the work.

It may be of interest to notice a few of the many other points of interest revealed in a perusal of the systematic portion.

In the Ranunculaceæ the embryo is minute and embedded in a copious endosperm, and we do not find the great variety in shape which usually obtains where the cotyledons have to be packed in a given space owing to the embryo occupying the whole seed.

The prevalent type of cotyledon is broad and bluntly ovate or oval; *Ranunculus arvensis* quoted above (Fig. 9) is an example; *Ceratocephalus falcatus* (Fig. 8), with its linear cotyledons, is a marked exception. The genus *Anemone* shows the greatest amount of modification; the petioles of the cotyledons are more or less connate in most species at the base, but in *A. coronaria* half-way up, in *A. rupicola* nearly to the top, in *A. polyantha* quite to the top with the blades also somewhat connate at the base; in *A. nemorosa* the petioles are quite suppressed. *Delphinium* affords an instance of an interesting relation between length of hypocotyl and presence or absence of petioles in the cotyledons. Thus in *D. staphysagria* the cotyledons are almost sessile, but the hypocotyl is three centimetres long, in *D. elatum*, on the contrary, the hypocotyl is very short, but the cotyledons have long petioles; in both cases the elevation of the cotyledon is assured.

This relation is also noticed between two species of *Vitis*, and again between *Eucalyptus marginata* and *E. calophylla*.

Clematis may be cited as an instance of the occurrence of aërial

and subterranean cotyledons in the same genus; *Clematis graveolens* has aërial cotyledons like all the other specimens of Ranunculaceæ described, but in *C. recta* (Fig. 21) they are fleshy and do not leave the seed, and as usual in such cases the first leaves are small and soon drop, in the figure they have already fallen. The same occurs in the genus *Phaseolus*, where *P. vulgaris* has its cotyledons borne up on a long hypocotyl, while in *P. multiflorus* they remain below ground in the seed. In *Clematis*, however, the aërial cotyledons are foliaceous, but in *Phaseolus* they are thick and fleshy, wrinkled and turned to one side of the stem, and only a pale green, looking as if they ought never to have left the seed, and the hypogæal were the normal state. In *Erythrina monosperma*, also a member of the tribe Phaseoleæ, the cotyledons are aërial, but thick, fleshy, and pale yellow, while in *E. suberosa* and *E. vespertilio* they are subterranean.

In *Chimonanthus*, belonging to the Calycanthaceæ, a small order closely allied to the Ranunculaceæ, the fleshy cotyledons fill the seed, but are aërial, becoming foliaceous and persisting for more than a year; the two following pairs of leaves are small and perish early.

The cotyledons of *Anona palustris* (Anonaceæ) are aërial and closely resemble the true leaves, but in several species of the genus they never leave the seed, but are torn from the axis during germination.

In spite of the great diversity of the fruits and seeds in the Cruciferæ, the cotyledons may be grouped under a few leading types. They may be broad and entire, as in *Matthiola incana* (Fig. 3), or broad and emarginate, as in the radish, cabbage (Fig. 18), or mustard. The linear form of *Heliophila* is unusual, while the spathulate type represented by *Bunias orientalis* seems to be due to growth after germination, as the cotyledons are narrow and spirally coiled in the seed. *Schizopetalon walkeri* and the common cress (*Lepidium sativum*) are exceptional in having divided cotyledons (Fig. 22). In the former they are bipartite, looking like four narrow cotyledons, and it is suggested that this may be a device for getting rid of the seed, as there seems to be some difficulty, the narrow arms having to struggle out through a small orifice. In the cress, on the other hand, the two lobes of each cotyledon help to fill up the extra large seed.

The cotyledons of *Viola tricolor* (Fig. 23) closely resemble those of *V. palustris* (Fig. 24), but the shape of the leaves is very different in the two cases.

Hibiscus phœniceus (Malvaceæ) has dimorphic seedlings, one form retaining the simpler form of leaf much longer than the other.

In *Linum monogynum* (Lineæ) (Fig. 25), the cotyledons are much longer and broader than the following leaves, an unusual circumstance, but recurring occasionally, as in *Olea cuspidata* (Fig. 26) and *Hakea acicularis* (Proteaceæ).

Under Leguminosæ we may notice the gradual reduction of the leaves to spines in the gorse (*Ulex europæus*) (Fig. 27); and the appear-

ance of the pinnate form in the early leaves where the later are reduced to the petiole (phyllodes) as in the acacia (Fig. 28). The figure of a pod of *Medicago orbicularis* (Fig. 29), containing nine germinating seeds, gives a good idea of the competition among seedlings where a fruit contains several seeds, and yet does not rupture. The same results where one seed contains many embryos, as in *Ardisia japonica* (Fig. 30).

The variety in Leguminosæ contrasts with the great similarity prevailing among the seeds and seedlings of the following order, Rosaceæ.

In the sun-dew (*Drosera*) it is interesting to find that even the first leaves catch insects, though the gradation to the adult form is very gradual.

Under *Viburnum* (Caprifoliaceæ) is described the development of the lateral raphe which almost encompasses the seeds—a very exceptional case in any natural order of Phanerogams. It is found to result from a localisation of growth in the lower end of the young seed. (Fig. 31.) The distance between the chalaza and the hilum and micropyle remains unaltered, while, owing to growth of the lower part of the seed, the raphe seems to creep farther and farther round it.

Psychotria (Rubiaceæ) is remarkable in that the cotyledons are provided with stipules.

The germination is of special interest in Valerianeæ and Dipsaceæ, where the single seed remains in the fruit, which is usually capped by a membranous crown (involucel). In *Scabiosa australis* (Fig. 32) the involucel is short and the base of the hypocotyl has a sort of foot which presses against its rim, pinning it to the earth. In *S. graminifolia* (Fig. 33) the radicle, which here also makes its exit at the upper end of the fruit, pierces the membranous lamina of the involucel, fixing it to the soil by a thickening at the base of the hypocotyl.

The cotyledons of the buckwheat have the two halves unequal, as in the geranium, and for the same reason, as they are curved like an S in the seed. The hop (*Humulus*) affords an interesting comparison; the cotyledons are spirally coiled to fill the nearly globular seed, but the inner has one coil more than the outer, so that after germination the two are equal in length.

A full account is given of the development of the cotyledons of the walnut (*Juglans*), where they are subterranean, and its ally *Pterocarya*, where they are aërial, the corrugated folds of the former corresponding to the spreading lobes of the latter.

The seedling of *Casuarina* (Fig. 34) is curious, resembling that of the Gymnosperm *Ephedra* (Fig. 35) (Gnetaceæ).

Finally, we may notice the good series of figures illustrating the germination of the water-plantain (*Alisma plantago*) (Fig. 36).

We have only briefly alluded to a few of the many interesting points which arise from a perusal of the text, and a comparison of the

figures and descriptions by which each family is illustrated. There is still room for almost boundless speculation, and even when we have duly digested Sir John's classical work, we are fain to admit with Klebs that the diversity in form, and its biological significance, is often still a riddle, though here and there some light has been thrown on its solution.

A. B. RENDLE.

EXPLANATION OF FIGURES.

N.B.—*c* indicates a cotyledon.—The numbers in Figs. 8, 9, and 23 indicate the order of development of the leaves.

1.—Seedling of *Opuntia occidentalis*. (Nat. size.)
2.— Do. *Echinocactus viridescens*. (Nat. size.) Cot. indicates one of the minute cotyledons.
3.— Do. *Matthiola incana*. (Nat. size.)
4.— Do. *M. bicornis*. (Nat. size.)
5.— Do. *Æschynomene aspera*. (× 2.)
6.— Do. *Indigofera australis*. (Two-thirds nat. size.) C indicates the place from which the cotyledons have dropped.
7.— Do. *Pueraria thungbergiana*. (Nat. size.)
8.— Do. *Ceratocephalus falcatus*. (Nat. size.)
9.— Do. *Ranunculus arvensis*. (Half nat. size.)
10.— Do. *Sapindus inæqualis*. (Half nat. size.) S, seed containing the cotyledons.
11.— Do. *Clarkia sp*. Showing different stages. (× 2.)
12.— Do. *Streptocarpus* (hybrid). A, B, and C, × 5. D, older seedling, Nat. size. F L, first leaf, developed from one of the cotyledons. C, the other cotyledon. S L, second leaf.
13.—*Galium aparine*, germination. (× 4.)
14.—*G. saccharatum*, germination. (× 4.)
15.—*Pinus rigida*, germination. (× 2.)
16.—*Chenopodium bonus-henricus*. (× 8.) A, vertical; B, transverse section of seed; showing cotyledons and radicle.
17.—Sycamore (*Acer pscudo-platanus*). (Nat. size.) Fruit and embryo, showing two modes (A and B) of arrangement of the cotyledons.
18.—Seedlings of *Brassica oleracea*. A (× 4) cotyledons still folded; B (× 3), cotyledons spread.
19.—Section through embryo of *Geranium*, showing mode of folding of cotyledons.
20.—A, longitudinal section of fruit of the lime (*Tilia*) (× 4); Pc, Pericarp; O T, outer; I T, inner coat of seed; H, hilum; Ch, chalaza; P, endosperm; C, cotyledons; A O, aborted ovules. B, seedling. (Nat. size.)
21.—Seedling of *Clematis recta*. (Nat. size.)
22.—Stages in germination of *Schizopetalon walkeri*. (× 2½.)
23.—Seedling of *Viola tricolor*. (Nat. size.)
24.— Do. *V. palustris*. (Nat. size.)
25.— Do. *Linum monogynum*. (Nat. size.)
26.— Do. *Olea cuspidata*. (Two-thirds nat. size.)
27.— Do. *Ulex europæus*. (Nat. size.)
28.— Do. *Acacia verticillata*. (Half nat. size.)
29.—Pod of *Medicago orbicularis*, with seeds germinating. (× 2.)
30.—Germinating seed of *Ardisia japonica*, showing six embryos. (× 2.)
31.—Longitudinal sections of fruit of *Viburnum* in three stages. (× 5.) R, raphe; Ch, chalaza.
32.—Commencement of germination of *Scabiosa australis*. (× 6.)
33.— Do. do. do. *S Gramuntia*. (× 4.)
34.—Seedling of *Casuarina*. (Nat. size.)
35.— Do. *Ephedra vulgaris*. (Two-thirds nat. size.)
36.—*Alisma plantago*, stages in germination. A, B, and C, × 8; D, × 4; E, nat. size; F, nat. size; *C*, cotyledon.

For the illustrations we are indebted to the courtesy of Sir John Lubbock, Bart., and of Messrs. Kegan Paul, Trench, Trübner & Co.

SEEDLINGS (Figs. 1—6).

7.

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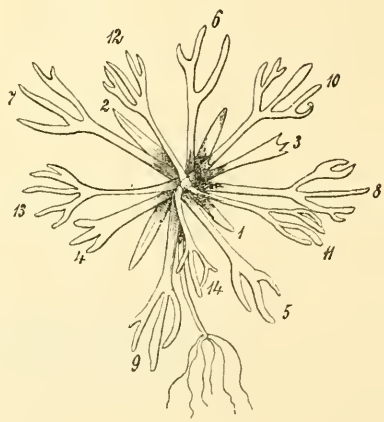
9.

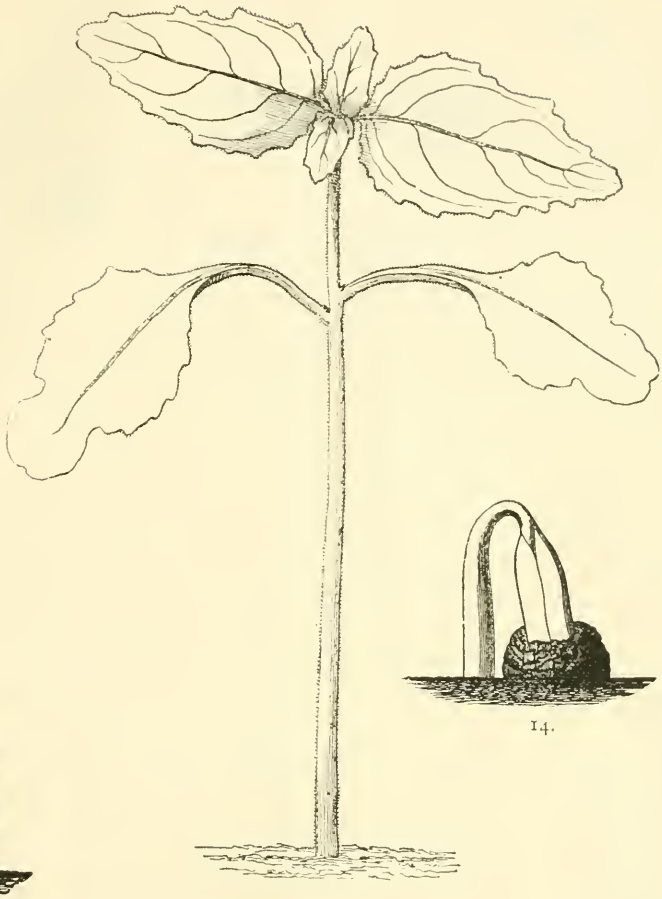


8.

SEEDLINGS (Figs. 7—10)

IIA.

IIB.



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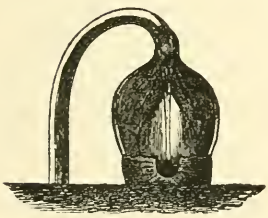

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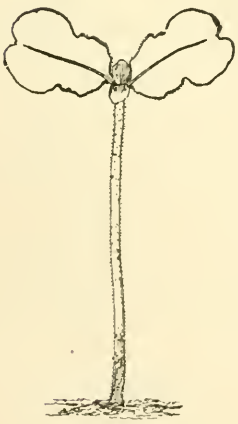


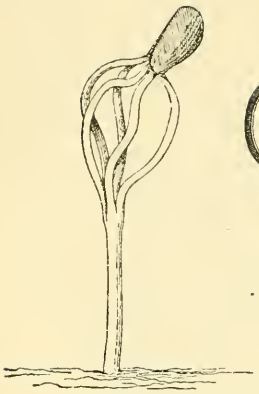
IIC.

12A.

12B.

12C.

SEEDLINGS (Figs. 11--14).



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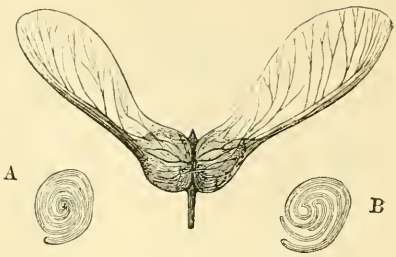

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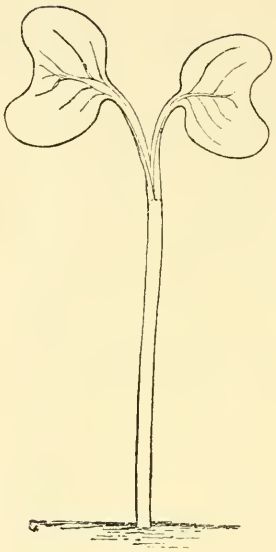
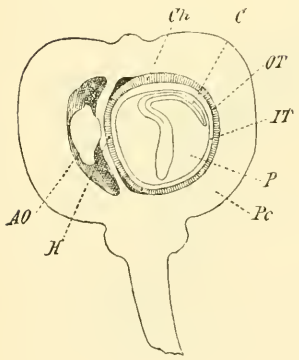


18B.

19.

18A.

20B.



20A.

21.

SEEDLINGS (Figs. 15—21).

23.

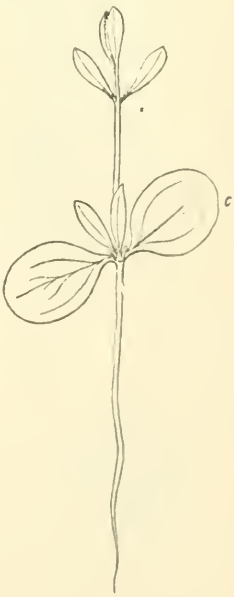
24.

22A.

22B.

22C.

26.



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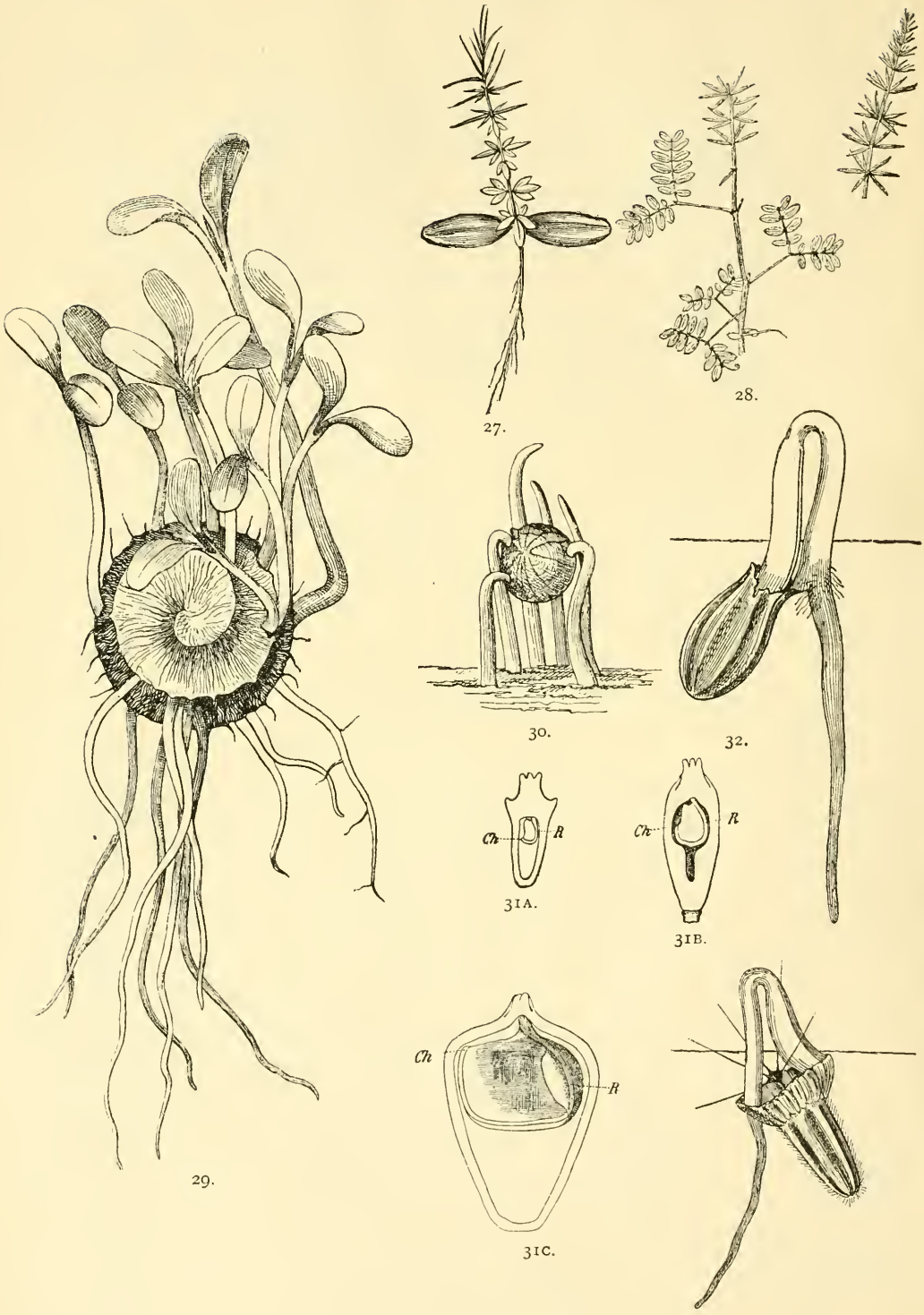
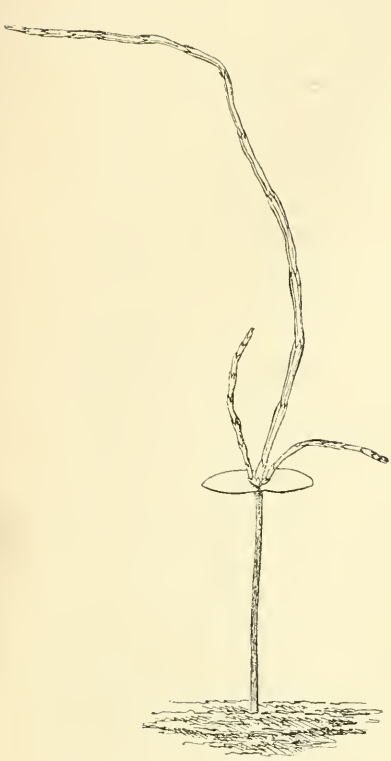
SEEDLINGS (Figs. 22—26).



27. 28. 29. 30. 31A. 31B. 31C. 32. 33.

SEEDLINGS (Figs. 27—33).



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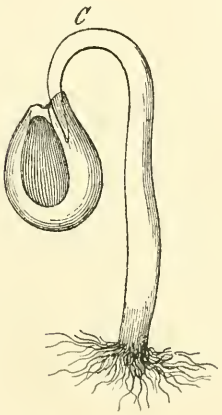
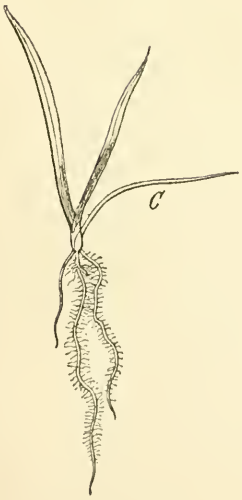


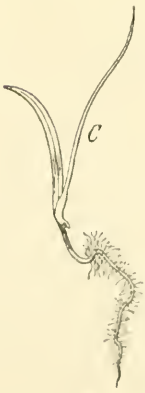
36B.

36D.



36F.

36C.



36E.

36A.

SEEDLINGS (Figs. 34—36).

V.

Exploration in New Guinea.[1]

WHAT may be called the golden age of exploration in New Guinea dates from about the year 1870. Previous to that time various navigators had laid down for us different portions of coast line, beyond which almost nothing was known. During the last two decades scarcely a year has passed without some expedition of greater or less importance visiting its shores. Since the establishment of the Protectorate in 1884, our knowledge has grown with marked rapidity. To the distinguished mariners Kolff, Blackwood, Owen Stanley, and Schleinitz, and to those talented surveyors Moresby, Field and Pullen, we are indebted for the accurate delineation of its coast-lines, and of the depth and trend of its under-water margins. To such naturalists as Macgillivray, Teijsman, Meyer, Wallace, D'Albertis, Beccari, Miklucho Maclay, and Macgregor, we chiefly owe the materials we now possess for the biological history of the country. Prominent among the large contributors to the geographical features of the interior of New Guinea are Van der Crab, Lawes, Chalmers, Maclay, D'Albertis, Pfeil, Cuthbertson and others, of whom the present Administrator, more favoured than his predecessors, in wielding the authority and the resources of the Possession, as well as profiting by the experience of preceding explorers, is pre-eminent.

Of the three territories into which the great island is divided, the British possession, occupying its narrowest part, and being easy of access from both shores, has been far best explored. Of the interior of the Dutch portion we know very little indeed, and of late years almost no exploratory work has been attempted, nor any colonisation, though it will probably yet be found that the Netherlanders possess in the slopes of the Charles Louis Mountains, which are said to ascend by gentler gradients than those of the Owen Stanley range, the most valuable and salubrious tract of the whole island. Of the large region on the south-eastern coast, between the meridians of 135° and 141° of east longitude, we are in almost entire ignorance. It is probable that much of the country for a long distance inland south of the 5th parallel of south latitude will be found quite low and similar to the adjacent region of the Fly River, which lies across the

[1] "British New Guinea" By J. P. Thomson, F.R.S.G.S. Pp. xviii., 336, with map and numerous illustrations. London: George Philip & Son, 1892. Price 21s.

141st meridian, the Anglo-Dutch boundary line. That portion of our Possession lying between its boundary line and the 146th meridian is as large as the whole of the rest of our mainland portion. It is occupied chiefly by the deltas of the rivers draining the ranges running along the confines of Kaiser Wilhelm's land, which have as yet been sighted only from a long distance. D'Albertis described the interminable swampy flats extending for hundreds of miles along both sides of the Fly, the largest of these rivers, and the more recent explorations of Sir William Macgregor have but confirmed the observations of the Italian traveller. This is the chief and almost the only level land on our southern coast, but in being swampy, very malarious, rarely approachable in the dry season because of the surf that hides the reefs, and accessible only by sea during the quieter rainy season, when most of the land is inundated and its rivers are flooded and dangerous, it is of no practicable use now, or likely ever to be till time has elevated it higher above sea level. No minerals have been discovered in this region in payable quantity; nor has recent exploration brought to light any extraordinary additions to its fauna or flora. The palæontological specimens brought back by recent expeditions are few and in poor condition, but they are just sufficient to indicate that in the Papuan Gulf region there occur Tertiary beds of Miocene and Pliocene age, containing mollusca and corals, some of them related to forms found in the Tertiary of Patagonia, and others similar to species now living in the Pacific Ocean. These beds overlie (whether directly or indirectly is unknown) strata of Jurassic or perhaps of Lower Cretaceous age.

In the remaining portion of the Possession, the two highest summits have been ascended within the last few years—Mt. Owen Stanley by the Administrator himself, and Mt. Yule by Mr. Belford. The interest of the splendid achievement of the ascent of Mt. Owen Stanley centres in the account of the fauna, and, perhaps, especially of the flora of its alpine regions, where have been found commingled South American, New Zealand, Australian, Himalayan, and European forms, affording us data which must be of the greatest assistance in the solution of the distribution of life in the Southern Hemisphere. The ascent of Mt. Yule was too rapid, and the party too short-handed, to reward Mr. Belford with any special novelties among plants and animals. This mountain is 10,600 feet in height, and stands isolated from the Owen Stanley range, and from the others of the same cluster, all of them being volcanic. In the plains to the south-west, a large lake, the only one yet known in New Guinea, was discovered, varying from three to eight miles in width, situated between Mt. Yule and the sea, twelve miles distant from the coast. During his official voyages of inspection, the Administrator has visited Rossel, Joannet, Sudest, and St. Aignan, the larger islands of the Louisiade Archipelago, and made excursions of greater or less extent into the interior of several that had never before

been penetrated. With their geological formation and their inhabitants we had in a general way been fairly well acquainted, through the observations of the naturalists of H.M.S. "Rattlesnake," and of many others who have visited the archipelago for various purposes from time to time. The annual reports issued by the Colonial Office —which one would scarcely think of consulting for scientific observations of an exact kind—record additions to our knowledge of the north-east coast and of the D'Entrecasteaux Islands made by Sir William Macgregor. He appears to have touched at a few places not previously visited, but, except in matters of detail, he has contributed little to the excellent descriptions given by Captain Moresby in his account of his surveying voyage along that coast; or to the observations made by the officers with Sir Peter Scratchley on board the "Governor Blackall," in 1884. The Administrator's visits to the Trobriand, Woodlark, and Laughlan islands have, on the other hand, augmented our previous information. The whole of the group appears to have recently been elevated, or to be still rising. Most of the islands are surrounded by raised beaches and cliffs of elevated coral, as is the case also in many parts of the Louisiade Archipelago.

Crossing over into German territory, we find that Herr Hugo Zöller has recently determined that the mountains running southward, parallel to the coast from Astrolabe Bay, are separated by an open space from the Finisterre range, which he ascended to an elevation of 9,000 feet. From this spot he discovered, in the Bismarck range to the west, an enormous snow-capped summit, which he believes to be the highest peak in New Guinea, and to the south still another range—probably an extension of the Rawlinson Mountains—attaining also an altitude of 10,000 to 12,000 feet. The north-westerly summits of the Victor Emmanuel range, which were discovered by D'Albertis from his furthest on the Fly River, have been estimated by Sir W. Macgregor, who sighted them from the upper reaches of the same river, to ascend to 12,000 ft., as disrupted and precipitous peaks. Whether they terminate the range, or whether they run on north-westerly to meet the Charles Louis Mountains is a problem left for some future explorer to solve. The region between these ranges and the line of peaks west of the British boundary is still occupied by a blank in our maps, which widens as it proceeds northward, till it unites with the great unknown expanse of Central New Guinea, belonging partly to the Germans, but chiefly to the Dutch. Though much of the interior is unknown, the whole of the north-east coast has been well surveyed, but the number of rivers that fall into the sea along its length is remarkably few, even opposite the great mountain ranges.

Meteorological observations taken at several places on this north-east coast and in China Straits show that the distribution of rain-fall depends on the position of a place in regard to the prevailing winds. In this region rain comes generally with the north-west monsoon, and in the Southern summer, and the table of rain-fall at

Hatzfeldt Haven shows its monthly maximum (14·88 inches) in the summer. Finsch Haven is, on the other hand, sheltered from the monsoon, but lies open to the trade wind, which reaches its greatest development in the Southern winter, and strikes the east side of Huon Gulf, and of the peninsula which juts out north of it. Thus the monthly maximum of rain falls there in July. The north-east coast, although not so directly swept by the trade wind as the east coast, is not altogether outside its influence. Thus we find here a secondary maximum of rain-fall in July, when the trade wind is at its height.[2]

This short summary has been suggested by the perusal of the latest addition to the list of works on New Guinea, a volume just published by Messrs. Philip and Son, entitled "British New Guinea," by J. P. Thomson, of the Royal Geographical Society of Australasia. "The author having during the past six or seven years (so he tells us in his preface to the English edition) contributed numerous papers on subjects connected with New Guinea to the Geographical Societies of Australasia, England, Scotland, and France," has now essayed to place "before his numerous and distinguished co-workers in the department of Geographical Science an authentic record of our knowledge of Her Majesty's youngest colonial possession—a modest contribution to the British reader." He has been good enough to inform us that he bases his qualification for undertaking a volume on "the physical and broad geographical aspects of New Guinea" and picturing truly its Melanesian inhabitants, on his being in Fiji a surveyor and fellow-officer of the "distinguished Administrator" of the Possession; and he has an "intimate acquaintance with Polynesians and other coloured races." In order also to produce a "book different from the ordinary narrative of travel—something of a representative character—" he was fortunate in obtaining the co-operation of workers eminent in geology, botany, zoology, and the languages of the country.

Adequately impressed by these remarks, we turned, with much expectancy, to the book itself. After reading the very meagre historical sketch which forms the first chapter, we proceeded to the second, headed "Explorations in the Louisiade Archipelago." To our amazement, we discovered that they were not the explorations of the *author* of the "numerous papers on New Guinea," but the explorations of "a beloved administrator," *compiled* by Mr. Thomson. Nowhere in the book could we find that the compiler himself had ever been in New Guinea. The title page would have been less misleading if it had run:—British New Guinea: the Explorations of "His Honour the Administrator of the Possession and others," paraphrased out of the official reports and papers elsewhere by J. P. Thomson. The only original portions of the book

[2] Proc. R.G.S., 1891, p. 176.

are the valuable scientific appendixes prepared by "the distinguished collaborators" of the compiler. We hope that these gentlemen will feel equal satisfaction in the association, and appreciate the title conferred upon them. The pronoun *we* is used throughout the volume in a sense which is not altogether customary. It is employed by Mr. Thomson as well when he is relating the exploits of Sir William Macgregor, in which he can have had no part, as when he is giving expression to his own opinions. For instance, on page 188 we find it stated, "to the knowledge of its (the Fly River) tributaries, *we* have made several important accessions"—a way of putting it that reminds one of the well-known story of the organ-bellows blower who claimed an equal share in the compliments bestowed on the organist's skill.

In a work printed and published in 1892, we are surprised to find no mention of the ascent of Mount Yule, so successfully accomplished on Christmas Day, 1890, by Mr. Belford, who accompanied Sir William Macgregor to the summit, and the writer to the base of Mount Owen Stanley; nor any recognition taken of the elaborate surveys of Commanders Pullen and Field, R.N. In this compilation, the observations made by the officers under Sir Peter Scratchley in the "Governor Blackall" are totally ignored, and places fixed and entered in the map published for the Protectorate Government soon after his death are claimed as new discoveries and re-named. If Mr. Thomson could have condescended to consult the literature of his subject, as authors who desire to be accurate generally do, he would have found in the volumes of the Royal Geographical Society of London information that might have saved him from many mistakes. The observations also made during Mr. Douglas' voyages while Special Commissioner are never referred to, nor are Mr. Milman's, nor Mr. Romilly's. Captain Moresby's thorough survey of the north-east coast is apparently entirely forgotten in our compiler's eagerness to claim renown at all hazards for the hero of his book; for we read on pages 172, 173, "this coast has hitherto been comparatively unknown . . . Recently, however, the pall of obscurity which for ages clothed the coast has been uplifted by the British New Guinea Government, and we [!] are now enabled to describe the geographical conditions with some degree of authority." It is to be regretted also that everywhere throughout the book the name Mt. Victoria is still applied to Mt. Owen Stanley. On the occasion on which Sir William Macgregor's paper was read before the Geographical Society in London, the president pointed out that this peak had borne for nearly forty years the name of the captain of H.M.S. "Rattlesnake," and that it had been distinctly given to the peak and not to the range. We venture to believe that even Mr. Thomson's persistent use of the new designation, in spite of the attention repeatedly called to the scientific illegality of the change which he apparently intentionally ignores, will not be effectual in

legalising this unwarrantable contravention of the laws as to priority of geographical nomenclature.

Although the book would, from its title and preface, lead one to expect a general account of British New Guinea in all its aspects, it is almost entirely devoted to an exposition of Sir William Macgregor's exploits. Yet narrowed down to this, the record of so much work of the highest excellence and importance would have been welcome if it had been compiled with more judgment and less bias; and if in its preparation the official reports had been followed more closely, we should have been spared many inaccuracies, and much bad grammar, as well as a superfluity of inflated language which in a book which its maker hopes may be "welcome to students of Natural Science," is nauseous in the extreme.

The names of the authors who have contributed the scientific appendixes to the volume are sufficient guarantee for their accuracy. Especially valuable are the vocabularies furnished by the Rev. W. G. Lawes, and those collected by the Administrator in so many different districts of the Possession. We miss with regret any report on the mammalia, on the birds, and on the land and fresh-water mollusca, though they are, we believe, to be found in the Parliamentary papers. The distribution of these groups is peculiarly interesting, and we should have been grateful for a complete *résumé* of the fauna collected here from the publications through which the notices are scattered, and especially from the official papers, where they are practically buried. Throughout the volume there are several excellent illustrations, and there is a good map. The publishers are to be warmly congratulated on the binding, paper, and printing of the book.

HENRY O. FORBES.

VI.

The Migration of Birds.

THE subject of the Migration of Birds is one which has attracted much attention in times both ancient and modern. It is only, however, during recent years that any light has been thrown on the probable origin of these periodical movements by the collection of new facts and observations from every part of the world, so that now the general principles and laws which govern the movement are capable of being better understood, and the chosen paths of the bird through the air remain no longer shrouded altogether in mysterious gloom.

In the new volume, mentioned below, Mr. Dixon has brought together from various sources, doubtless with much painstaking research, a great array of facts bearing on this special subject, and these he has endeavoured, how far successfully we must judge, to reduce to some system or law.

The book is divided into twelve chapters, with special headings, and the first of these deals with ancient and modern views of migration and the presumptive habit of Hibernation; in the terrestrial form of which, as opposed to the subaqueous, Mr. Dixon seems to retain some sort of belief, and as a suggestive fact, which he thinks deserves notice, tells us that the winter quarters of the two most northerly ranging of the Hirundinidæ, namely, the house and the sand martin, are yet practically unknown. Is it possible, he asks—without venturing to express any decided opinion—that the most northerly birds hibernate and pass the long boreal winter in torpidity? Mr. Dixon does not seem to be aware that both these species, which have a most extended range, cross the Mediterranean, in spring and autumn, on migration in great number, and the range of the latter is known to go as far south as the Transvaal.

The subject of the hibernation of some birds may, however, be dismissed as unworthy of serious consideration.

Passing to the subject of Migration, the author thinks that birds change their countries from necessity, and that instinct or hereditary desire gives the impulse to move, but then gives place to reason, memory and knowledge of locality. He is evidently no believer in the

[1] The Migration of Birds. An attempt to reduce Avian Season-flight to Law. By Charles Dixon. London: Chapman and Hall, 1892.

inherited instinctive sense of direction possessed by birds in general, and the power of passing from one extreme of their range to the other without the assistance of land marks, or, in the case of the young, direct guidance or personal conduct of such old birds who have made the journey before. A little examination, however, will show that his hypothesis cannot be maintained. It is a well-known fact that the young of various species of wader breeding in high latitudes flock together when they have acquired their flight feathers, and, perfectly independent of their parents, migrate to southern lands, and appear late in July or early in August on the East Coast of England at a time when the supply of food is still most abundant in the arctic lands they have left—lands also in the full glory of the latter summer when as yet the sun has hardly dipped below the horizon.

Birds go north in the spring to reproduce their species. When this is accomplished, the young are cast off and have to shift for themselves, and in all matters relating to food and movement are dependent on their own inherited instincts to find their way to the ancestral winter quarter—old and young, with the same common object, can and do act independently. The old also are not always able to follow the old trail southward, but frequently enough, under unfavourable meteorological conditions, are compelled to make considerable deviations from the normal route; hence it is that the phenomena of migration vary so much from year to year, both as observed on the East Coast of England, and for half a century at Heligoland. The act of migration in the young bird is not a habit improved and acquired by observation or instruction, or in any sense to be compared to the training of a homing pigeon, a production of artificial selection and most careful education to a special purpose, and, while possessing no doubt, with all birds, an inherited and instinctive sense of direction more or less latent, has never been subjected to the struggle for existence and the same necessities as a wild bird.

The occurrence of young and old of various species together in the great autumn "rushes" is no indication of personal guidance, and the young of the year are quite as capable of reaching their winter quarters as the old, and for anything we can tell the impulse, instinct, or whatever we may choose to call it, is more strongly developed in the young and vigorous. The great majority of birds migrate during the night, and this alone will preclude any guidance of the young by the old, or knowledge gained by experience of leading land-marks along the route.

Among the waders the earliest arrivals on the East Coast of England are often a few old birds more or less in faded summer plumage. That these cannot have in any manner acted as guides, or voluntarily undertaken the task of personally conducting the young, is obvious from the time of their arrival not conforming within days and weeks with that of the birds of the year.

Young birds migrate in the autumn unattended by the old, and without any previous knowledge of the route. The force, stimulus, or impelling power is what we call instinct, which may be defined as a special adaptation to a special circumstance, a non-intelligent action, that is instinctive, and, as it has been recently expressed,[2] performed in virtue of the innate and co-ordinated mechanisms of the organism, an innate capacity developed by Natural Selection. Instance the selection of a butterfly of the leaf upon which she lays her eggs, the only leaf, it may be, which serves her grubs, and a food of the kind which she herself does not eat; the instinct of a young pointer, brought up away from the parent, drawing on game and standing the first time it is taken into the field; the instinct of the young bird which, independent of all guidance and unimproved by intelligence, can find its path unerringly to the winter home of its parents across thousands of miles of land and water.

Regarding the origin of these ancient and complicated movements, granting that birds have ascended from reptilian ancestors, they would begin to emigrate from place to place as soon as the exigencies of life and their powers of aerial locomotion became developed. There is, however, no necessity, when considering the origin of migration and those ever-varying phenomena which now attend these movements, to go back to the great unthinkable ages—the cooling down period of the earth's existence, when the Arctic and Antarctic zones became first capable of supporting life; the key and explanation of the mystery may be found in a comparatively recent geological period, commencing with the slow recession of the great ice-cap from Europe and North America in Post-pliocene times.

There is nothing in the present position of bird life in the globe which can be accounted for by the present known geographical distribution of species; the explanation must be sought in the unreckoned ages of the past.

Mr. Dixon dwells much on what he calls inter-polar migration, and endeavours to prove the probability of some ancestral forms of the Charadriidæ inhabiting, during remote ages, a south polar area. He considers that long journeys now taken by some species of waders to south of the Equator—as the knot, curlew sandpiper, sanderling, and grey plover—and reaching over 140 degrees of latitude, or nearly 10,000 miles direct, are the result of the transfer of these species from the North Polar Basin to the South Polar Basin during favourable intervals of climate. Unfortunately for Mr. Dixon's theory, there is absolutely no proof in the present distribution of bird life that the antarctic regions were ever the breeding quarters of the progenitors of the vast bird hosts which now repair in the breeding season to the immense solitudes surrounding the North Pole. All scientific evidence points in the opposite direction, and to the conclusion that life has

[2] "The Study of Animal Life," J. A. Thomson, chap. x., Instinct.

not been distributed from the South Pole. If, in some remote period, life existed there—and there is no reason to suppose the contrary—it has long since been extinguished and crushed out by the superincumbent ice-cap, from which no retreat was left open. A comparatively narrow strait or channel of ancient sea is known to be sufficient to separate and keep apart very distinct faunas, and to have proved an all-sufficient barrier to the passage and inter-breeding of birds; and, so far as our knowledge goes, from the very earliest period of this earth's history the great Antarctic continent has been isolated by the oldest and deepest oceans—a belt 700 miles across in the narrowest part—reposing on a foundation of primitive rocks, and without any sedimentary deposits suggestive of ancient land-lines.[3]

The only probable representatives now surviving of an Antarctic avifauna are the Penguins and, perhaps, some of those Petrels which are so numerous in the Southern ocean.

It is to the North Pole then that we look for the origin of present life on the globe, both animal and vegetable, and it is in this polar origin of life that we must in the future expect to find the key to the riddle of migration in Post-pliocene ages. In the great North Polar continent of the Eocene period, with its tropical warmth and abundance of space and food, and the facilities of unbroken land routes extending to the boundaries of the Antarctic Circle, and the subsequent vast climatic changes of the Pliocene age, which were slowly and gradually evolved, we find the primary factors in bringing about the present distribution of bird life on the globe, and the segregation and differentiation of species. The subject, however, is much too vast to enter upon in a short review.[4] The autumn migration, then, of birds to south of the equator cannot be explained by heredity or any inherited love of home, at a time when the Antarctic world was the favourite ancestral breeding ground, and the Northern Hemisphere a winter home.

Mr. Dixon gives in a tabulated form, under the headings of "Incipient," "Short," "Moderate," "Long," "Extended," illustrations of the longitudinal range of various species; and as an example of "incipient" migration, with a normal range of 1,000 miles downwards, cites the Grey Phalarope (*Phalaropus fulicarius*), a species circumpolar in its breeding quarters, and migrating southward for winter to Scinde, Northern Africa, and Central America. Again, the knot is quoted as an instance of "extended" migration, covering from 7,000 to 10,000 miles. The fact is, however, that the winter range of those

[3] "The Polar Origin of Life considered in its bearing on the Distribution and Migration of Birds." By H. B. Tristram. *The Ibis*. Part I., 1887, p. 236; part II., 1888, p. 148.

[4] Those interested in the subject of the North Polar distribution of life should read Mr. Seebohm's "Evolution of Birds," "Differentiation of Species," "The Glacial Epoch," "Migration," being chaps. II. to V. of "The Geographical Distribution of the Charadriidæ."—H. Sotheran & Co., London, 1888.

knots which pass along the West Coast of Europe extends from Southern Scandinavia, along the British and Continental coast-lines, to the south of Africa, wintering wherever the conditions are favourable along that line for the support of life. Several instances could be adduced to show that an abnormal supply of food in a special locality has the effect of staying altogether or retarding the passage and range of species which, under normal conditions, would have been more extended. The extent of the longitudinal migration of a bird is the affair of the individual, not of the whole race, moving from one extreme of the range to the other. Therefore, it appears to be impossible to draw, as Mr. Dixon attempts to do, deductions as to short or long migratory flights correlated with ancient or more recent geological epochs.

There are certain general laws of migration accepted by ornithologists; these may be briefly stated. (1) Each bird (excepting purely tropical species) breeds in the coolest, that is the most northerly, part of its range, and that these nesting quarters are reached by horizontal migration. Some species and individuals, however, obtain the necessary conditions for reproduction in a vertical migration by ascending mountains till they meet with the same climatic conditions which exist in high latitudes. (2) Northward migration is for reproduction, southward for food and climate. (3) Birds which go furthest north to breed often retire the furthest south. (4) Each species has its regular periods of migration. (5) No bird is known to breed a second time during absence from its northern home.

The lines of migration, or bird routes, in the east and west Palæarctic and Nearctic regions are infinite and differ in the case of each species and even with individuals. The general direction is from north to south, but there are many variations apparently running in very erratic directions; the bird lines also vary from time to time under the influence of the weather. There are also certain routes or great highways where the migratory host focusses its millions into streams. Such is the line across Heligoland and along the west coast of Europe. There are also many facts suggestive of birds continuing to follow persistently ancient land-lines, now submerged; and we know of no species or individuals which systematically cross seas or oceans where land has not probably existed in recent or more remote geological ages, and since the habit of migration has been evolved.

There is evidence of ancient lines of migration still followed by a few species between India and South Africa, also by Eastern Asia to New Zealand, and from the western coast of North America to the Isles of the Pacific, routes which, probably at some remote period, offered greater facilities over a more continuous land surface. Evidences of more recent land routes are suggested across the North Sea to the British Islands, and over the Mediterranean by Sicily and

Malta. Where a line of migration has been used from remote ages, birds continue to follow the same by hereditary instinct, be it sea or land.

Within comparatively modern times some species of Western Palæarctic birds are known to have extended their summer range eastward, and likewise Eastern Palæarctic birds have spread westward; yet notwithstanding the increased geographical area occupied —notwithstanding the much greater distances to be traversed—they still continue to follow the old lines of migration which they have been accustomed to from the remotest periods.

Islands situated far from migratory routes, as a rule, become isolated areas, and include in their special avifauna the greatest number of endemic species. The reverse is the case when they are situated within the range and influence of long-established routes. As one instance of a sedentary and island species which does not migrate, Mr. Dixon has inaptly chosen the so-called St. Kilda wren. This most unfortunate little bird was recently (1884) exalted into a distinct species under the name of *Troglodytes hirtensis*, but without sufficient cause; and one result is that it has already been exterminated by greedy collectors, who are able to offer the poor islander considerable reward for its capture.

Mr. Dixon says "it is a rule almost without exception that the wings of migratory birds are long and pointed"; also "that migrants decline to make any very extended flights across the sea, except the most fleet-winged and robust." "Small terrestrial species of comparatively feeble flight choose, invariably, the easiest way across, where choice is possible." The fact is, however, that many birds, with wings suggestive of weak flight, or such as are not in the habit of taking extended journeys on land, do succeed annually in the autumn in crossing the North Sea in its widest part in a single flight. Such are the jay, grey shrike, common wren, hedge-sparrow, redbreast, great and blue titmice, water-rail and others. On the other hand, some purely sedentary species possess long and pointed wings.

Having lived near the East Coast of England nearly all our life, we have in each autumn had unusual opportunities, for days in succession, of watching immigration in actual operation, and to note that, under the conditions of favourable weather, birds appear to be absolutely unaffected by the sea passage; and even after a bad crossing—storms or adverse winds or driving snow—a few hours' rest seems sufficient to enable them to renew the journey.

We cannot understand what Mr. Dixon intends when he speaks of "migratory land-birds, many of them frail in form and constitutionally weak and feeble." Such, had they existed, would have been surely eliminated in the life-struggle, and only the most vigorous and robust left to migrate. The occurrence of the turnstone in Polynesia and New Zealand, the sanderling in the Hawaiian Islands and Galapagos Archipelago, the Siberian bar-tailed godait (*Limosa uropygialis*)

in New Zealand, the New Hebrides, and Norfolk Island; the knot in New Zealand; the Asiatic golden plover in New Zealand, and the isles of the Pacific; and the short-eared owl, and others, in the Sandwich, Ladrone, and Caroline groups, are all suggestive of immense ocean flights undertaken by birds on migration.

At the same time, we confess we are very sceptical as to the fact of American land-birds crossing the Atlantic without a more or less assisted passage. Possible exceptions are the snowy owl and Greenland falcon, which are known to have occurred occasionally on the west coasts of Scotland and Ireland, arriving most likely by a route direct from Greenland by the Färoes, and, it may be, assisted by drifting ice. American birds which turn up in the British islands probably travel first north along the East Coast of Greenland, and across the Pole, then south along the Scandinavian coast-line; in support of which it may be urged that the greater portion of stragglers which reach our shores from the New World are recorded from the East and South coasts as far west as Devon and Cornwall. Many of these latter have no doubt first struck the East Coast, and followed the coast-line to the south-west limit of land.

When on the subject of altitude, Mr. Dixon remarks "that in no part of the world do any regular migration routes cross seas too wide to be bridged by the eye of a bird flying at a sufficient altitude." Does Mr. Dixon seriously mean that a migrant over the North Sea, between the Elbe and Humber, can bridge the entire distance of four hundred miles with its eyes from shore to shore, and this by night as well as by day, and in all conditions of weather? What is intended by "sufficient altitude"? and is it really the case that birds in the sea-passage do move as a rule at vast altitudes? The height of migratory flight appears to be dependent on wind and weather: under favourable barometric conditions—chiefly anti-cyclonic—birds will fly high,[5] but in cyclonic periods, the prevailing weather in the autumn, very low; and when over the sea just clearing the water or following the curve of the wave. Often when on the North Sea in the autumn have we seen for hours in succession flights of birds moving westward low near the surface; and in the autumnal "great rushes" over and past the East Coast lightships, the observers, acting on behalf of the Migration Committee of the British Association, have yearly entered in their schedules the records of a low-flying and continuous migration, often lasting for days and weeks. All experience, then, independent of mere theory, is in the direction of a low or medium flight, showing that very lofty flight is the exception and not the rule in the autumnal passage of the sea. The inrush of migrants coming under our own observation on the East Coast of Yorkshire in the last autumn was in many respects very instructive,

[5] With gentle northerly and easterly winds birds are noted as often flying high. Strong winds, however, from any quarter, are known to beat them down to the surface of the sea.

showing the capabilities of small land-birds to make a successful passage of the sea under the most trying and adverse conditions :—

On October 13, wind northerly, moderate, very fine, little or no migration ; one woodcock, one golden-crested wren, and a few redwings, the latter increasing in the afternoon. Early morning of 14, soon after midnight, wind veered to east, blowing more than half a gale, with heavy rain continuous to morning of 16th. During this time very heavy migration, low flying when actually seen. Enormous numbers of gold-crests came in, also nearly equal numbers of redbreasts, these two species, separately, probably outnumbering all the others put together ; these included rough-legged buzzards, about 20 grey shrikes, long and short-eared owls, rooks, starlings, larks, great numbers of blackbirds, ring-ousels, thrushes and red-wings, stonechats, willow-wrens (very many), hedge-sparrows, woodcock (first-flight), common and jack snipes ; also a few grey crows and field-fare on 16th. The circumstances under which the sea passage was made, on the three days, must have been very trying to the birds ; a continuous heavy rain, with a strong easterly wind, and so thick that a large steamboat, anchored a mile from the shore, was seldom visible ; nights also pitchy dark. In fact the meteorological conditions were such as to preclude any special advantages of guidance or sight operating to the advantage of the migratory hosts pouring helter-skelter on to the land.

" The young birds," Mr. Dixon tells us, " are the greatest blunderers, the birds, which have practically no knowledge whatever of the road, and have to depend entirely on the guidance of older birds. That this is the case is abundantly proved by the fact that nearly all the birds that accidentally wander to the British Islands from more or less remote countries are birds of the year " (pp. 178–9).

Although sufficient British statistics are yet wanting, we are inclined to think that among our rarest visitors on migration—birds which have lost their route or been driven over by stress of weather, adults turn up nearly as frequently as the young of the year. We have now before us a list, kindly supplied by Mr. Gätke, of Heligoland, showing for the last fifty years all the rare captures actually made on the island. Of 133 exceptional occurrences, belonging to 20 species whose home is Greece, Asia Minor, Palestine, Southern Russia, Turkestan, &c., with few exceptions rare summer visitors to the island, and occurring in May to the end of July, 122 were adult, and 11 young. Of purely Eastern species, ranging as far as Kamtschatka, buntings and thrushes, occurring during September to the end of November, 34 are old and 13 young. Of American visitors, five have been old and two young. Of *Otocorys alpestris*, now a common migrant in the autumn, two-thirds are old. Of *Anthus richardii* and *Phylloscopus superciliosus* about one-half are old.

Mr. Dixon is inclined to underrate the work done in Heligoland by the veteran ornithologist Herr Gätke. It must be borne in mind

that the value to students of migration of this outpost cannot be reckoned merely by comparative lists of rare wanderers which have turned up on migration there and in the British Islands, but rather by the fact that the red sandstone rock—28 miles from the nearest coast of Denmark—is directly in the line of the principal bird highway between the north and south of Europe; while in no other place in the world have continuous notes been taken for fifty years, in connection with bird passage, and these by one of the oldest and most painstaking workers in Europe, one to whom the author of this book is indebted for some of his most interesting facts.

We think Mr. Dixon greatly overestimates the "Perils of Migration" to birds. These he divides under the heads of "Fatigue," "Natural Enemies," "Blunders and Fatalities on the Way." The death-rate from the three causes he puts as high as 500 to 600 for every thousand, or more than one-half, and of these he thinks by far the greater number succumb by sea. During forty years of observation on the East Coast of England we recollect only two instances in which we have found birds washed up in any numbers, and these were rooks, starlings, and redwings. It is true that occasionally, in fogs, snowstorms, and thick weather, as many as 1,000 to 1,200 birds are recorded as killed against the lanterns of lighthouses or lightships; these "big bird nights" are, however, the exception and not the rule, and the loss is small when compared with the multitudes on actual passage. The number of migratory birds which come within the influence of sea-lights is as a drop in the ocean in the great tide sweeping southward over Europe, Asia, and North America, and scarcely worthy of serious consideration. Probably falcons, hawks, owls, and greycrows are no greater causes of destruction to small migrants on passage than at any other period of their existence.

When on the subject of lighthouses, Mr. Dixon remarks that "The brilliant lamps of the lighthouses are too often the only visible places for which to steer—an inherent knowledge teaches them that light leads to safety." If the author's supposition be correct, then it must have been a bad time for the birds before lights were thought of. Artificial lights are of no use in directing or pointing out the route to be followed, as these beacons must be all much alike to passing flocks.

As an illustration of the rapidity of flight of some species during the spring migration, Mr. Dixon cites the Dotterel (*Eudromias morinellus*), estimating its progress from point to point—that is from North Africa to the Arctic Circle in a single flight between sunset and sunrise—at 200 miles an hour.[6] We doubt very much if normal flight on migration exceeds 50 miles an hour, and very frequently not

[6] When Mr. Dixon says this bird is scarcely ever seen in intermediate places in the spring migration, he appears entirely to have overlooked the fact that it is by no means an uncommon visitor in certain localities on the East Coast of England, frequently lingering some time before resuming its journey.

so much as this. That birds can and do fly with great rapidity for short distances we cannot doubt, but in a continuous journey of many hundreds of miles, the pace probably is not in excess of that of the carrier pigeon. In the migration report for 1885 the flight of woodcocks between the coast of Denmark and the West of England is calculated from fairly reliable data as probably not exceeding 52 miles an hour.

Space will not permit us any further to notice Mr. Dixon's book, although there are other points in which the facts do not appear to warrant his deductions, and we cannot consider this attempt to unravel the very complex web of migration successful. Although our knowledge of the subject has been greatly increased, many more facts and observations are wanted from all parts of the world before we can hope to arrive at any satisfactory and strictly scientific conclusions as to the periodical movements of

> " . . . . wild birds that change
> Their season in the night, and wail their way
> From cloud to cloud " . . . .

In recent years there has been a tendency to much wild speculation, and much written which will not stand the test of critical examination; and we are entirely in accord with our author when he says that " with the gradual growth of ornithology as a science the wildest opinions have been expressed, and the most absurd theories put forward, concerning " migration."

In conclusion, we may state that Mr. W. Eagle Clarke, of the Science and Art Museum, Edinburgh, is at present engaged in the laborious task of reducing the mass of information, collected during nine years by a committee of the British Association, from the reports annually published, and from an examination *de novo* of the schedules sent in from the lighthouses and lightships, so as to show on strictly scientific lines, in a condensed form, and by as clear a method as possible, the results of the enquiry. When this is completed it is hoped some fresh light will be thrown on the phenomena of migration as observed in the British Islands.

SOME NEW BOOKS.

THE BEAUTIES OF NATURE: and the Wonders of the World we Live in. By the Right Hon. Sir John Lubbock, Bart., M.P., F.R.S. 8vo. Illustrations. London: Macmillan & Co., 1892. Price 6s.

IN this new volume, Sir John Lubbock has produced a series of chapters, such as the tired naturalist will be delighted to read, though he will not find in them much that is absolutely new. The ordinary intelligent reader, without special scientific training, will also take up the book with pleasure, for the author possesses the rare gift of explaining difficult scientific problems in perfectly simple language. Sir John Lubbock takes for the texts of his different chapters various common natural objects, and in passages which will be appreciated as much for the charm of the language as for the ideas expressed, he points to the beauty and unfailing interest in Nature everywhere.

In ten chapters the author speaks of animal life, plant life, woods and fields, mountains, water, rivers and lakes, the sea, and the starry heavens; each chapter dealing, of course, with a few only of the problems. For instance, among the various headings in the first four chapters we find Sir John's special subjects: Communities of Animals, Senses of Animals, Structure of Flowers, Insects and Flowers, Fruits and Seeds, Seedlings, Ants and Plants, &c. Then the chapters deal with wider themes, and under "Woods and Fields" there are descriptions of Tropical Forests, of Meadows, and of Downs. Chapter VI. speaks of Mountains, their origin, scenery, and inhabitants, and of Volcanoes. Chapters VII. and VIII. treat of Rivers and Lakes, and their origin, thus leading to Chapter IX., the Sea.

The book is capitally illustrated, with the exception of one or two of the plates, for which the process adopted is not suitable. The plates we do not like are those representing "Aquatic Vegetation, Brazil," and the "Summit of Mont Blanc." The process used does not succeed with the fine lines of the feathery vegetation, or with the masses of white snow.

THE GREAT WORLD'S FARM; some account of Nature's Crops and how they are Grown. By Selina Gaze. 8vo. Pp. x. and 365, with 16 plates. London: Seeley & Co.

THIS is the best popular scientific book we have seen for a long time. The authoress has first thoroughly mastered her subject, often giving evidence of extensive knowledge of minute detail and wide research into the literature; and then in two and twenty chapters, almost every one of which is a complete little story in itself, she tells the tale in language which though simple is not silly, and is accurate though popular. The plates, of which we reproduce an example by the courtesy of the publishers, are often taken from exhibits at the British Museum of Natural History, or from photographs of living plants at Kew; and there are also wood-cuts scattered through in the text.

A MANGROVE SWAMP.—*(From Gaze's "Great World's Farm.")*

The first chapter is introductory, and shows how man, with all his machinery, is, after all, greatly dependent on natural forces for the production of his crops. Chapter II. brings forward the "pioneer labourers," the gases of the atmosphere, moisture, frost, alternation of heat and cold, wind and rain, glacier and volcano, the great natural forces which split or wear away the fundamental rock. Then come the humbler "soil-makers," the tiny lichen, which, living on the bare rock, helps to break up the surface and by its decay to form a thin film of soil in which mosses can root, to be ultimately followed by dwarf shrubs. But the soil to be really productive must be mixed; any one rock will not supply the necessary ingredients in fitting proportions. This leads to the consideration of the soil-carriers, the river and the wind, and we are made to feel the truth of the old proverb that "a peck of March dust is worth a king's ransom." The use of the bind-weed and its relatives, the salt-worts, the mangrove, and other soil-binders is duly explained; and then follow two most interesting chapters on the "field-labourers," the burrowing mammals, earth-worms, burying beetles, termites, ants, and ant-eaters.

However rich and well prepared the soil, the plant cannot get on without water, and Chapter VIII. deals with its absorption, retention —especially by desert plants—and transpiration. This leads to "deserts," those regions where the soil may or may not be poor, but where water is scarce, and which are hence comparatively barren. The relation between want of water and scarcity of vegetation, especially of trees, is brought out, and stress is laid on the frequency of drought as a result of ruthless demolition of forests. Roots and food from the soil, leaves and their work, followed by a short chapter on climate, blossom and seed, and the development of the second from the first, the working of Nature's golden rule for flowers—"cross fertilisation" wherever possible, guests welcome and unwelcome, and the scattering and carrying of seeds, are subjects of successive chapters. The "Chances of Life" gives a graphic account of the keen struggle for existence, and some of its causes, in the vegetable kingdom. Under "Friends and Foes" the relation between animals and plants is aptly described, the foe of the individual being often the friend of the race. "Nature's Militia" is just now more appropriate than ever when the plague of field-mice in the South of Scotland has been evoking so widespread an interest. The last chapter—"Man's Work on the Farm"—includes a brief historical summary of the changes in vegetation which man has, intentionally or otherwise, effected by his migrations and taste for cultivation.

The work as a whole is so good and so admirably put together that one quite regrets to find a slip such as is evidently the statement on p. 162, to the effect that one part in twenty-five thousand is the proportion of carbonic acid gas present in the air; it should be one in two thousand five hundred, or ·04 per cent. It is not correct to say that the leaf of *Dionæa* secretes an acid which digests the captured insects, for though the acid may be a necessary accompaniment, the peptic ferment is the actual digestive agent. In the chapter on "Chances of Life," the authoress, while rightly denouncing the popular error of mummy-wheat's germinating, unfortunately adduces, as well-authenticated, the statement that seedlings were raised by Dr. Lindley in Chiswick Gardens from raspberry seeds found in Celtic tumuli, perhaps some two thousand years old, and mentions also as a fact the germination of seeds from Roman tombs. These "facts," however, have never borne the light of investigation, and

it is much to be regretted that the authoress has gone astray on a subject which has been so thoroughly threshed out.

MODERN SCIENCE IN BIBLE LANDS. By Sir J. William Dawson, C.M.G., F.R.S. Popular Edition revised. 8vo. London: Hodder & Stoughton, 1892. Price 6s.

THE wide title of Sir W. Dawson's book obviously allows the inclusion of a multitude of interesting topics on geology, volcanoes, and early flint implements, before the topography of the Holy Land with the resources and prospects of Bible lands is reached. The author, to do him justice, avails himself of this to the full, and thus succeeds in putting together a volume of much value both to students of the Bible and the Earth. "It is my desire," he writes, "to lay before the reader a clear statement of the local facts which have furnished to me the solution of doubtful and disputed questions, and to throw on the Hebrew and Apostolic literature such light as may be afforded by the structural features and geological history of the countries of the Bible." The book, in short, may be regarded as a modern Bridgewater Treatise, and, it may be added, it possesses all those elements of interest which characterised the original treatises. Sir W. Dawson's bias against Darwinism is well known, and it is only fair to state that he here delivers many damaging blows to that theory. Thus the evidence against Pliocene Man is strongly marshalled. "I have for many years," he adds, "maintained the recency of man on geological grounds, more especially on the evidence of the absence of any change in organic beings, or any considerable physical changes since his introduction, and of the rate of cutting of river valleys." He points to the recession of the Falls of Niagara (which is fully illustrated here) as affording conclusive testimony of this. Man belongs, therefore, to the modern period alone. He has only existed on the earth for 6,000 or 7,000 years. We give this conclusion *valeat quantum*. It must be left for students to trace its steps for themselves.

The character of this book being so wide and covering so much ground, it is possible to discuss numerous subsidiary topics, as it might seem at the first blush, but which form in reality parts of the author's argument. Thus the primitive Chaldæan documents recently discovered are pressed into the service of defending the Bible. Professor Sayce is quoted to show the extreme antiquity of the art of writing. The critical school has often assumed that it was unknown in Palestine before the age of David; whereas, "long before the Exodus Canaan had its libraries and its scribes, its schools and literary men." The characters were in the Babylonian language, not Phœnician but cuneiform, as the tablets of Tel Amarna testify. The flint implements of Egypt, the Nile mud, the pyramids, and a multitude of ancient objects and geological changes are carefully treated. Sir W. Dawson's pages deserve to be seriously weighed, and they are written in so pleasant a style that they attract the reader instead of repelling him by marshalling a number of bare facts. The author's derivation should be borne in mind, however, during this study: "when facts fail to sustain certain theories, we are usually in the habit of saying 'so much the worse for the theories,' not 'so much the worse for the facts,' or at least we claim the right to hold our judgment in suspense till some confirmatory facts are forthcoming." His arguments derived from the border-land where geology and mythology seem to meet are somewhat untrustworthy speculations. They enable the student, however, to understand over what a wide region such enquiries as those which are here pursued must necessarily lead him.

With regard to what may be termed the second part of the book, nothing but praise can be awarded. The physical structure of Egypt in connection with the residence of the patriarchs and of Israel in that country is most carefully drawn out and illustrated by maps and figures. Palestine is treated in the same painstaking fashion. The topography of the Exodus, as portrayed by the author's own as well as by the most modern researches of other travellers, is fully detailed. Appendixes and an index enable the reader to find what he wants at once. Whatever he may think of Sir W. Dawson's geological conclusions and his views on palæocosmic man, he will entertain but one opinion on the industry, the acuteness, and, above all, the conscientiousness of Sir W. Dawson. This is only what his previous publications would lead all to expect.

Curiosités de l'Histoire Naturelle. By Henry de Varigny. Small 8vo. Pp. 413. Paris: n.d. [1892]. Price 3fr. 50c.

This work may be described as a kind of scientific "Half-hours with the best Authors." The book mainly consists of a series of excerpts from different writers, and these not always, it may be observed, very well-known writers. With the names of Darwin, Wallace, Paul Bert, de Saussure, and M. de Varigny himself, there are a number of others which it would be invidious to mention, but whose dicta do not exactly carry weight.

The author explains in his preface that his book is intended for young readers, and that it is furthermore intended to amuse as well as to instruct; it might, therefore, have been wise to correct several fables which are included, such as the old story about the *Hydra* turning itself inside out and living just as happily in the reversed condition.[1] On the whole, however, we think this a decidedly interesting little book. We do not pretend to have read it through; it is not a book to read studiously, but to pick up for an odd half-hour, which odd half-hour will be by no means unpleasantly spent.

F. E. B.

Experimental Evolution. By Henry de Varigny, D.Sc. London: Macmillan and Co., 1892, *Nature Series*. Price 5s.

This volume contains the lectures given by Dr. de Varigny, in 1891, at Professor Patrick Geddes' fascinating Edinburgh Summer School of Science and Art. If in his English the author needed much of the assistance from Professor Geddes and Mr. J. A. Thomson he so modestly acknowledges, he could have been advised by none better, and the book is pleasantly and clearly written.

The first lecture gives a general account of evolution, with an avowed list to French contribution. At the end of the lecture the case for experimental evolution is stated. In the second and third lectures variation in nature, and in the fourth, variation under domestication, are considered as the groups of fact upon which experimental evolution must be based. In the last lecture, the author explains that change of environment, use and disuse, natural, sexual and physiological selection must be the methods of enquiry; that the enquiry will be difficult and prolonged, and will raise many side issues of interest.

This is all well-meaning, and the amiable author may be justified of his book if he stimulates readers to take an interest in natural

[1] *See* Natural Science, vol. i., p. 86.

history beyond the collection of specimens; and for this, his abundant collection of facts and experiments dealing with variation and the influence of changed environment will no doubt suffice. But, alas! if these readers set up aquaria, and in the name of scientific investigation diligently tease their inhabitants; for experimental work, to be of the slightest value, must be done in a much more critical and disciplined way than they are likely to learn from Dr. de Varigny. At least that is so if his observations of animals and plants at all resemble his observations of the authors he cites. Take one or two examples.

On page 107, after an account of Yung's experiments on the determination of sex in Tadpoles, he proceeds:—"Thus food, and the nature of food, has much to do in the determination of sex. The same is the case with bees, where the production of queens, workers, and drones is in great part a matter of nutrition. A worker larva may be reared into a queen, if royal food is provided." Quite so; but if Dr. de Varigny had read with any attention even the short account given by Geddes and Thomson (to whose book he refers on the same page) he would have seen that, while royal food may ripen the latent sex of a worker, a different factor has to do with the distinction between male and female.

On pages 223 and 224 the author gives an account of the modifications produced by cultivation on *Bacillus anthracis*, and then proceeds: "It seems, then, that Professor Weismann goes certainly too far when he asserts that we have no proof of the direct production of transmissible changes by means of external influences. It may be said that he restricts his denial to the metazoa." It may indeed! In this restriction and its consequences is the very gist of Dr. Weismann's difficulty about the transmission of acquired characters.

On page 225 the author writes:—"On the other hand, we possess, in the facts of domestication and cultivation, a large number of cases of variation—which occurs in every part—due to environment, and transmitted by inheritance in various degrees." If the statement were true there would be no controversy.

On pp. 229 and 230 he quotes with approval from Le Conte (*Monist*, April, 1891) his curiously inept classification of the factors of evolution. Of the five heads, the first two are most interesting:—

"First.—Presence of a changing *environment* affecting functions, and functions affecting structure, and the changed structure and function inherited and integrated through successive generations indefinitely.

"Secondly.—*Use and Disuse* of organs re-acting on growth force, and producing change in form, structure, and relative size of parts, and such change inherited and integrated through successive generations."

To include together an admitted truth and a disputed interpretation, so that denial of both may be attributed to those who differ from one about the latter, is an old device of political controversy; but it is unsuited to scientific writers, whose purpose is to reach the truth rather than to confound their adversaries. P. C. M.

ELEMENTARY BIOLOGY. By H. S. Campbell, M.D. London Swan Sonnenschein and Co., 1892 Price 6s.

THIS excellently illustrated little book includes all the types selected by the conjoint Board of the Royal College of Physicians and Surgeons for the examination in Elementary Biology. It also goes over the ground prescribed in the syllabus for that examination.

The chapters on animal classification are the weakest. Metazoa are divided into Vertebrata and Invertebrata. Of the latter, it is stated that the nerve cord or cords are never dorsal. Dr. Campbell must know very well that there are dorsal cords in both nematodes and *Balanoglossus*. The further subdivisions and reasons given for them are not at all good. Sponges do certainly *not* "form the connecting link between the unicellular animals on the one hand and multicellular animals on the other." The classification of Vermes is quite inadequate.

Of course classification of the Animal Kingdom in a few pages is impossible, and its details to anyone who intends to get no further than elementary work are useless. But Dr. Campbell should have taken more care with this part or omitted it altogether.

Otherwise, the book is well treated, and seems quite suitable for its purpose. P. C. M.

AN INTRODUCTION TO THE STUDY OF BOTANY, with a special chapter on some Australian Natural Orders. By Arthur Dendy, D.Sc., and A. H. S. Lucas, M.A. Pp. xv. and 271. Illustrated. Melbourne: Melville, Mullen and Slade, 1892.

THERE is certainly no dearth of text-books on Botany, yet each new teacher of the Science is fain to admit, like the authors in the present case, that "hitherto no single elementary book has been sufficient to fulfil all requirements," and forthwith to compile a new one which may be above or below the average. The requirements are, perhaps, sufficient justification for the appearance of the work before us, in which Messrs. Dendy and Lucas combine an account of the general structure and life-history of plants, with a special study of Australian forms.

The book is divided into two parts. Part I. (General Botany) is a progressive study of the series of plant-forms, commonly known as types, which are nowadays considered to illustrate best the various groups and the advance in complexity of structure and function from the lowest or simplest to the highest. The stonewort, *Chara*, has been omittted, we think wisely, for it is certainly "a very aberrant form," and therefore not one for an elementary text-book, though not necessarily "of little value in comparative morphology." With the description of structure is blended an explanation of function, and except for occasional looseness the physiology is well and carefully expressed. A few points, however, call for remark. The cells of a plant should not be compared with the bricks of a house without explaining the vital difference between the two, especially when in the same page we read that they are generally "united together in groups" to form tissue, which recalls the building of a house by the bringing together of originally separate elements.

In Chapter II., under *Protococcus*, starch, cellulose, and sugar are mentioned as allied substances having a similar composition and generally known as *carbohydrates*; but the few words necessary to explain wherein lies the similarity are wanting. *Protococcus* is also described as a "typical" vegetable cell; one hardly knows what to understand by "typical," but a cell consisting very largely of protoplasm is certainly not the commonest form, which must rather be sought in such an one as Vines adopts in his "Physiology" to illustrate cell principles, namely, the ordinary tissue-cell with a delicate "primordial utricle" lining the wall. In spite of a few blemishes like

these, the first part, which is mainly Dr. Dendy's work, is a clear and well-written account of the principal forms and their relations to each other.

In the second part, Mr. Lucas deals with the morphology of flowering plants, and gives a description of a few of the more important Australian Natural Orders. The five chapters in which the root, stem, leaf, flower, and fruit are respectively considered, form a capital little introduction to structural and systematic botany; the matter is well connected, while nothing important has been overlooked. In referring to twining plants, however, it is not correct to say that the stem swings round its support "much in the same way as a weight attached to a string held in the hand and swung round"; this view of the vital process of twining is too mechanical for modern notions of physiology. A good classification of inflorescences and fruits is given; and the last chapter contains short descriptions of twenty-three Natural Orders, grouped according to the plan adopted by Baron von Mueller in his census of Australian plants. No apetalous division is recognised, and Euphorbiaceæ, Casuarineæ, and Salsolaceæ are found among the hypogynous polypetalæ; but recent research has shown that the Casuarineæ, at any rate, have no place in this group. An appendix gives useful hints on collecting, observing, preserving, and describing flowering plants.

The book is illustrated with thirty-one plates, the figures in which are sometimes original, sometimes borrowed from previous authors, such as Sachs, Le Maout and Decaisne, and others. They are, on the whole, clear and good, though occasionally sketchy. The text is well produced, on good paper, and remarkably free from misprints.

CASTOROLOGIA: or the History and Traditions of the Canadian Beaver. By H. T. Martin. 8vo. Pp. xi. and 238. London: E. Stanford. Montreal: Drysdale and Co., 1892. Price 10s. 6d.

WHAT Mr. Hornaday has done for the American Bison, and Mr. Barrow for the House Sparrow in America, Mr. Martin has accomplished for the Canadian Beaver in the present exhaustive memoir. The value of such animal biographies can scarcely be overrated to the working zoologist, and this value is much enhanced in the case of creatures which, like the Canadian Beaver, are only too likely to share the fate which has already overtaken the American Bison.

That the Canadian Beaver is, indeed, a doomed animal, seems only too apparent from the work before us, Mr. Martin stating in one passage that its "days have been lengthened to the present, only by contributions levied upon the musquash and the coypu, whose numbers have been heavily taxed"; while later on he writes as follows:—"As to the ultimate destruction of the beaver, no possible question can arise, and the evidences of approaching extermination can be seen only too plainly in the miles of territory exhibiting the decayed stump, the broken dam, and deserted lodge. The passing bear or wolverine tears open the lodge, partly in the vain hope of finding a meal, partly from habit; the rising waters float the logs away, while the drifting ice in fall and spring gradually destroys the dam, till within a decade, where once the busy colony spent their happy domestic lives, no sign remains of all their wondrous toil."

The author treats his subject in a most thorough manner, commencing with the mythology and legends relating to the beaver, next passing on to the considerations of the larger fossil forms more or less

nearly related to this animal, and then devoting a chapter to its living European congener. The fourth chapter treats of some of the more important of the other larger American Rodents, while the fifth and sixth describe the life-history and geographical distribution of the animal forming the subject of the memoir. These are followed by others treating of the engineering feats accomplished by this interesting Rodent, and of the importance of the animal in commerce and manufacture. In the concluding chapters we have interesting accounts of beaver-hunting, of experiments in the domestication of the animal, of its anatomy and osteology, and, lastly, of the beaver in heraldry. Finally, three appendixes reproduce some documents and accounts relating to the animal as known to the earlier settlers.

Whether, therefore, the reader is interested in the beaver from a purely zoological, from a distributional, from an historical, or from a commercial point of view, he will find plenty of matter in this work worthy of his best attention; and the book will, indeed, prove absolutely invaluable to all who may have to write upon any one of these divisions of the subject. The illustrations with which the work is embellished are for the most part excellent, and, as life-like scenes, we may especially call attention to the picture of a beaver-haunt which forms the frontispiece, and to the plate of the "beaver-canal" facing p. 72; while as an example of the illustration of a morphological structure, the figure of the tail of the beaver on page 179 is beyond all praise.

From a literary point of view, Mr. Martin strikes us as being at his best when describing the habits of the beaver in the fifth chapter. In his preface the author takes the precaution to inform his readers that he is not a practised zoologist; and, this being so, we venture to think he would have been better advised if he had taken counsel from someone who is, in regard to the strictly zoological portions of the work. We find, for instance, on page 35, the following sentence:—"The River-rat, or Coypu as it is called by the natives, is in many ways the intermediate species between the musquash and the beaver, and having been known as the 'Castors of La Plata,' might appropriately be named the South American beaver." Now, with all due deference to the author, we think that a more *inappropriate* term could scarcely have been proposed; and when it is remembered that the beaver, the musquash, and the coypu severally belong not only to three perfectly distinct families, but likewise to as many different and apparently divergent sections of the Rodent order, we quite fail to perceive how the latter can in any sense be regarded as intermediate between the other two. Then, again, we must take exception to the statement on page 36, that the affinities of the capybara, which the author terms the "water-hog," "are evidently there with the pachyderms,"—whatever he may mean by the latter obsolete term.

The author's observations on the habits of the beaver will be found full of interest; and many erroneous ideas as to the engineering powers of the animal will be, we may hope, thereby finally dispelled. Attention is directed to the prevalent notion that the beaver always fells his timber in the direction of the water; the true explanation of this being that trees on a river's bank always naturally incline in that direction. The theory that the beaver's "lodge" is merely a special development of the burrow of the musquash is new to us, but is doubtless the true explanation. There are many other observations of equal interest which we must leave the reader to discover for himself in a work which may lay claim to a high position among animal biographies.

R. L.

Marine Shells of South Africa. By G. B. Sowerby, F.L.S., F.Z.S. Pp. 89, pls. v. London: Published by the Author, 1892. Price 12s. nett.

This work is, as its title denotes, a list of the Mollusca inhabiting South Africa; it contains, however, diagnoses of a few new species, and is illustrated by numerous plates which place the book on a somewhat higher level than that of the simple catalogue. In looking over a work of this kind one develops a feeling of gratitude to those hard-working persons who are good enough to do for us this necessary but decidedly not entertaining labour; for, to our mind, there could be no more depressing pursuit in the whole field of natural history than the description of recent shells, excepting, perhaps, the description of fossil shells. The least exhilarating work of this kind that we know of is a vast series of tomes entirely devoted to the almost endless description and arrangement of the species of a single genus of bivalves, the genus *Unio*. The devotion of a lifetime to the study of antimony, in which something new could be discovered every day, is nothing to this. It is, nevertheless, a pity that those who spend their days in the examination of shells do not also take into consideration the contents of the shells. They do sometimes, it is true, speak depreciatingly of the "animal" in giving a description of a new species; but among the students of no group is there a more distinct separation between the anatomist and the systematist than in the case of the Mollusca.

Mr. Sowerby enumerates 740 species from South African seas, and estimates that more than 300 of these are confined to the region of which he treats. We fear, however, that the list cannot be complete, for we fail to find the new univalves, described by the Rev. Boog Watson in his "Challenger" report, and if that great work be overlooked it is not unlikely that some smaller contributions may also have escaped notice.

The work is beautifully printed, with useful illustrations, and deserves a place in every reference-library of Conchology.

Mountaineering. By C. T. Dent and others. Pp. xx., 439. With 13 plates and 94 other illustrations. London: Longmans, Green & Co., 1892. Price 10s. 6d.

The "Badminton Library of Sports and Pastimes," edited by the Duke of Beaufort and Mr. A. E. T. Watson, already comprises 14 volumes, some of which, on Hunting, Fishing, and Shooting, deal with subjects of interest to the Field Naturalist.

The volume before us on Mountaineering, however, appeals more directly to students of Natural Science. It is pleasantly written, and admirably illustrated with pictures that are both humorous and instructive, while the information will be valuable alike to those who ascend mountains as a pastime, and to those who pursue Science at the same time.

The short introduction is written by Mr. Justice Wills, one of the pioneers of modern mountaineering, who made the ascent of the Wetterhorn, from Grindelwald, in 1854. He remarks that "few sports, perhaps few pursuits, afford keener or more lasting enjoyment, or contribute more to the acquisition of self-reliance, patience, and self-restraint"; at the same time, he and other contributors to this volume adopt as their key-note, words of warning rather than of encouragement, and "teach the immorality, as well as the folly, of running into useless danger and risking valuable lives."

The first chapter is on the *Early History of Mountaineering*, by Sir Frederick Pollock; and it is interesting to learn that some of the philosophers and naturalists of the sixteenth and seventeenth centuries were foremost among the mountaineers of their days. Conrad Gesner, of Zürich, in 1541, "resolved for the future, so long as God grants me life, to ascend divers mountains every year, or at least one, in the season when vegetation is at its height, partly for botanical observation, partly for the worthy exercise of the body and recreation of the mind." Sir Frederick says that modern mountaineers ought to revere Gesner as a true ancestor, for he possessed the genuine mountaineering spirit.

Interesting accounts are given of the explorations of other pioneers, of Albert von Haller, Jean Jacques Rousseau, and De Saussure; and there is a reproduction of the old print representing De Saussure, his son, and guides, on the march in 1788. References are also made to the partial ascent of Chimborazo, in 1802, by von Humboldt.

The first recorded ascent of any permanent snow-peak was in 1739; the first successful attempt to reach the summit of Mont Blanc was made in 1786; and the final conquest of the highest peak of Monte Rosa took place in 1855. The author points out that, among English leaders of Alpine exploration in its most active period, a notable proportion were scholars and men of science.

The subjects of *Equipment and Outfit* (for women and men), of *Mountaineering and Health*, *the Principles of Mountaineering*, *Reconnoitring*, *Snow Craft* and *Rock Climbing* form the subjects of six chapters by Mr. C. T. Dent. It is shown that in rock climbing, as in snowcraft, scientific knowledge can always be turned to practical account; that an acquaintance with the chief formations of mountains, and their individual peculiarities, is as useful as a knowledge of the physical phenomena of glaciers and snowfields. Illustrations are given of the features produced by ordinary limestone, dolomite (magnesian limestone), and granite rocks; and of the relations between the dip of the rocks and the configuration of the slopes. The aid of Professor Bonney is acknowledged in reference to these matters.

Attention is drawn to the dangers of climbing steep grass-covered slopes. Thus "the inexperienced person who goes out for a ramble by himself will often attempt rock passages actually more difficult than any he would have to overcome if he ascended half-a-dozen of the reputedly most formidable rock peaks in the Alps"; and botanists, entomologists, and others, "professedly of sound mind," may start forth from their hotel, "shod in boots destitute of nails, and equipped with an umbrella or a walking-stick." The consequence is, they "find themselves in tolerably awkward predicaments," for grass, after dry and hot weather, is extremely slippery, and at a height of six or seven thousand feet the soil clings but loosely to the rocks.

A short chapter on *Maps and Guide-books* is contributed by Mr. W. M. Conway; a chapter on *Mountaineering beyond the Alps* is by Mr Douglas W. Freshfield; and *Climbing without Guides* is dealt with by Mr. C. Pilkington.

We pass on to *Hill Climbing in the British Isles*, also by Mr. Pilkington; a chapter of especial interest to home mountaineers. Our hills are always accessible, and most of them can be climbed at any period of the year, but there are many ascents that may be dangerous, and some that are impassable in the winter months. The author remarks that it is never well to ascend an out-of-the-way hill alone.

Sligachan, in Skye, is spoken of as "the rock-climbing centre *par excellence* of the British Isles," and the author remarks, "always take

a rope." The so-called "Inaccessible Pinnacle" of Sgurr Dearg is the Matterhorn of the district, and to climb it a man must have a steady head. The east ridge "is very narrow, with a sheer drop on each side; great care should be taken in the descent, one man only moving at a time, and let the last man be steady and keep the rope tight." Useful advice is given on the dangers of climbing chalk-cliffs. Speaking generally of our hills and cliffs, the author, however, remarks "that they form a good and safe training-ground where men may learn and practise nearly all that is necessary in the art of mountaineering."

Another chapter deals with the *Recollections of a Mountaineer*, by Mr. C. E. Mathews, who gives reminiscences of J. D. Forbes and John Ball (with portraits), and of others who have developed the craft of mountaineering, not omitting the great Alpine guides to whom mountaineers so largely owe whatever success they have achieved.

Mr. H. G. Willink contributes a short chapter on *Sketching for Climbers*, and Mr. Dent writes the concluding chapters on *Camping* and *Photography*. A Glossary and a good Index complete this very interesting volume.

New Works of Reference.

Part 10 of Taschenberg's *Bibliotheca Zoologica II.*, dealing with works 1861–1880, has lately been issued. It extends from Gastropoda to part of the section Pisces. The author visited London last month to complete his references to the publications of the British Field Clubs.

The volume of the *Zoological Record* for 1891 has appeared at an unusually early date (October, 1892). The editor, Dr. David Sharp, hopes in future to be able to issue the work in August or September of each year.

The Geological Survey of India has published an index to the genera and species described in the "Palæontologia Indica," and an index to the "Memoirs" of the Survey from 1859 to 1883. Both publications have been prepared by Mr. W. Theobald.

A third edition of A. de Lapparent's "Traité de Géologie" is being issued by F. Savy, Paris. The first volume of 567 pages, dealing with what Lyell termed the "Principles of Geology," has already appeared (though dated 1893). The second volume, treating of Geology proper, will consist of five fascicules, of which the first has also been received (though similarly dated 1893).

Messrs. Williams and Norgate have issued another useful "Natural Science Catalogue" (no. ix., 1893).

OBITUARY.

FREDERICK SCHWATKA.

BORN SEPTEMBER 29, 1849. DIED OCTOBER, 1892.

WE regret to chronicle the death of this able explorer. Schwatka was born at Galena, Illinois. After graduating at West Point in 1871, he was admitted to the Nebraska Bar, and about the same time took a medical degree in New York. He was a lieutenant of cavalry till 1877, and in 1878 was appointed as commander of the expedition to King William's Land. Among other most important work, he completed the gaps in the narratives of Sir John Rae and Sir Leopold McClintock; and he discovered skeletons of several of Sir John Franklin's party. His great sledge-journey on this expedition, which lasted from April 1, 1879, to March 4, 1880, covered 3,250 miles. He left the army in 1884, after a visit to Alaska, where he followed the course of the Yukon River. Returning to Alaska in 1884, as the leader of the "*New York Times*' Expedition," he explored the Mount St. Elias district, and ascended that peak to a height of 7,000 feet. After visiting Chihuahua in 1889, for the proprietors of the journal *America*, he once more returned to Alaska in 1891, and opened up some 700 miles of previously unknown country.

Schwatka's best-known works are:—*Along Alaska's Great River* (1885) and *Nimrod in the North* (1885). Mr. W. H. Gilder has recorded his 1878–80 expedition under the title of *Schwatka's Search*; *Sledging for Franklin Records* (1882).

THOMAS JOHN MOORE, A.L.S., CORR. MEM. Z.S.

BORN 1824. DIED OCTOBER 31, 1892.

BY the death of Mr. T. J. Moore on October 31 last, the Liverpool Museum loses its first Curator, and a familiar figure is removed from scientific circles in the seaport. The son of a Keeper in the Zoological Gardens, London, Mr. Moore early evinced a keen interest in Natural History pursuits; and at the age of 19 he was appointed Assistant-Curator of the Earl of Derby's Museum at Knowsley. On the death of its founder, the 13th Earl, in 1851, this collection was bequeathed to Liverpool, and Mr. Moore was then appointed Curator by the Corporation. During the last forty years he devoted unceasing energy to the perfection of the Museum, more

especially taking care to enlist the services of numerous friendly sea-captains in obtaining specimens; and the result of his labours is one of the foremost among provincial Museums, not merely of value to the student, but full of interest to the general sight-seeing public. Mr. Moore, moreover, not merely accumulated treasures, but made them available for the advancement of research, either by describing the novelties himself or by submitting them to those actively engaged in investigation—to Owen, Huxley, W. K. Parker, Darwin, and many others, who recognised him as a valued coadjutor. At the same time he interested himself in the spread of scientific teaching among the people, frequently lecturing; and during the years 1865 to 1884 he arranged and carried on the Liverpool Free Public Lectures. So long ago as 1860, Mr. Moore was elected a Corresponding Member of the Zoological Society of London; and quite lately he was made an Associate of the Linnean Society and an Honorary Member of the Literary and Philosophical Society of Liverpool. He was identified, more or less actively, with all the scientific bodies in the city of his adoption, and the large representative gathering at his funeral testified to the esteem in which he was held by those most intimately associated with him.

Mr. James Plant, F.G.S., died at Leicester on November 8, aged seventy-four. He was an active member of the British Association Boulder Committee, and did much useful geological work in the neighbourhood of Leicester.

M. Victor de Robillard, of Port Louis, Mauritius, well-known as an enthusiastic collector of Natural History specimens, died about three months ago. For a long time past he had sent to the British Museum rare and beautiful specimens of marine animals, one of the finest of which, *Cidaris curvatispinis*, was described by Professor Bell so recently as November 1 before the Zoological Society of London. The Botanical Department of the British Museum secured Robillard's collection of marine algæ a few years ago.

NEWS OF UNIVERSITIES, MUSEUMS, AND SOCIETIES.

Of the 250 students enrolled this Session at University College, Aberystwith, nearly one-third are women.

Mr. E. E. Prince, M.A., Professor of Zoology in St. Mungo's College, Glasgow, has been appointed Commissioner and General Inspector of Fisheries in Canada.

Dr. R. von Wettstein has been appointed Professor of Botany in the German University of Prague, Bohemia.

Mr. W. F. Smeeth, B.A., of Dublin University and the Royal College of Science, London, has been appointed Demonstrator of Petrology and Mineralogy in the University of Sydney.

Mr. George W. Card, Assistant-Demonstrator in Geology at the Royal College of Science, London, has been appointed Curator and Mineralogist to the Geological Survey of New South Wales.

Dr. George A. Koenig has been appointed Professor of Chemistry in the Michigan Mining School, Houghton. Dr. Koenig is well known as one of the first mineralogists in the United States, and was formerly attached to the University of Pennsylvania.

Dr. F. H. Hatch has resigned his appointment on the Geological Survey of Great Britain, and has gone to seek his fortnne in the auriferous districts of the Transvaal.

The University of Cape Town has been admitted to affiliation with the University of Cambridge. This is the second of the Colonial Universities thus affiliated, the other being that of New Zealand.

During the completion of the new buildings for the Durham College of Science, the Natural History Society of Newcastle-on-Tyne has lent one of the corridors in its Museum for the use of the practical classes in General Biology and Botany. The Botanical Department of the College has been re-constituted, the former lecturer, Mr. M. C. Potter, this Session attaining to the rank of Professor.

The annual conferring of degrees at the Royal University of Ireland took place on October 28. A conversazione was held in the evening at which a numerous company, including the Lord Lieutenant, attended. Besides musical and other attractions there were exhibits in Natural Science by Professors O'Reilly and Cole, who showed rock-specimens, and by Professor Haddon, who showed photographs of great anthropological interest, taken on a recent visit to the Aran Islands. The Royal University is only an examining body, but this annual gathering fosters a social feeling among its graduates. Something of the same kind might be of advantage to the University of London.

A VALUABLE collection of fossils, minerals, and shells, comprising several thousand specimens, and particularly rich in specimens from the Carboniferous formation, has just been presented to the University College of North Wales by Mr. Evan Roberts, of Manchester. It is hoped that this gift will become the nucleus of an important geological collection, suited to the educational requirements of a University College, and that similar gifts will, from time to time, be made to the College by those interested in the progress of geological study.

ACCORDING to the *Anatomischer Anzeiger*, the Biological Station at Plön (Holstein), under the direction of Dr. Otto Zaccharias, has accomplished successful work during the past summer, and has been visited by nearly one hundred zoologists and botanists Of the species of animals occurring in the Lake of Plön, there have been determined 20 fishes, 40 crustacea, 69 worms, 14 mollusca, and 74 protozoa; while among these there are 10 undescribed species and several new genera. Of greatest interest is the discovery in fresh water of many organisms that have hitherto been supposed to occur only in the sea; and among these more especially may be noted certain genera of diatoms, rhizopods, and worms. An illustrated report on the results is in preparation.

THE tercentenary of the establishment of the Botanic Gardens of the University of Montpellier will be celebrated next year, probably during the week from 10 to 18 June. Invitations have been issued by Professor Flahault for that date (subject to alteration), since it is the best season for botanising in that district. The Garden was founded by Henri IV., in 1593, and has had a distinguished history. Those botanists who are fortunate enough to be invited are assured a hospitable and cordial welcome. Professor Flahault published in 1890 an account of the admirable Botanical Institute, accompanied by plans of its arrangement and a photogravure view (Firmin et Montane, Montpellier), which will interest those who intend to be present. Among the herbaria of Sir Hans Sloane in the British Museum is a very valuable series of plants of historical interest from the Montpellier Garden.

AT a special general meeting of the shareholders of the Bristol Museum and Library on November 3, it was resolved "that the Council be authorised to transfer the Museum and Library, and all the property of the Association, to the Mayor, Aldermen, and Burgesses of the City of Bristol, upon such terms as the said Council may agree upon, consistently with discharging the debts and liabilities of the Association, and maintaining the Museum and Library for the use of the citizens of Bristol." The Association in its present form is due to the amalgamation of two societies, the Bristol Library, founded in 1772, and the Bristol Institution for the Advancement of Science and Literature, opened in 1823. The proposal to erect a building for the joint occupation of the two societies, and to be called the Bristol Museum and Library, was resolved on in 1867, but the process of raising funds and providing the building was a long one, and it was not until 1871 that the removal to the new home took place. Unfortunately, the funds at the disposal of the committee were not sufficient to carry into effect completely the original design, and in a few years it was found necessary to extend and complete the existing building, and especially to add a lecture hall. These works were resolved on in 1874, and the additional rooms were opened in 1876. Altogether, a sum of £22,000 had been expended on the building, of which about £6,000 was obtained from the sale of the Park Street building, and some £10,000 by donations contributed by those anxious to see the scheme carried into effect, and subsequently represented by shares or left in the way of voluntary donations. Before the Association took possession of its new home, it seems to have been in a flourishing condition for several years. It derived an annual income of over £1,000 a year from the subscriptions, and this reached the maximum in 1879, when, under the new circumstances, the institution was just paying its way. Since 1879, however, the subscriptions have continually decreased in amount, and it is now considerably in debt. The Mayor of Bristol,

Sir Charles Wathen, has generously undertaken to pay outstanding liabilities, on condition that the city accepts and agrees to maintain the museum intact; and there is thus a good prospect of the unique collection at Bristol becoming once more, as it was in former years, a leading factor in the progress of Natural Science in the West of England. The Council has the services of one of the most accomplished of Museum Curators, Mr. Edward Wilson, and it will be a real gain to Science if he can be placed in a position to carry out adequately the work that he has hitherto had to attempt under circumstances of extreme difficulty.

THE *Brighton Herald* of November 5 contains the first of a series of articles entitled "Half-hours in the Brighton Museum." The Willett collection of Pottery claims first attention, and is treated in several readable instalments by an expert. This collection, one of the largest and most curious belonging to a private owner in England, includes many rare examples of the inscribed pottery in which a former generation of Englishmen found a vent for expressing their patriotic and domestic sentiments or for celebrating national rejoicings and victories.

WE are glad to note that the Museum at Perth, in Western Australia, is not only growing, but is being more appreciated by the inhabitants of this vast colony Special attention is paid by the Curator, Mr. Bernard H. Woodward, to the natural products of the country, and it is anticipated that large additions will be annually made, if a sufficient grant be voted by the Government. Moreover, as the Aborigines are beginning to make use of European manufactures for the construction of their implements, it becomes increasingly desirable to acquire primitive specimens from those districts where they will soon be unobtainable.

THE Academy of Sciences at Philadelphia has commenced the extension of its museum by the addition of a new wing. There will be four stories and a basement, and the area of the building will measure about 130 feet by 50 feet.

ACCORDING to the *American Naturalist*, materials for a Museum of Ethnology at Chicago are now being collected in South America.

THE removal of Professor H. F. Osborn to New York has infused new life into biological movements in that city. In addition to his work as Director of the Biological Institute of Columbia College, he has organised a department of Vertebrate Palæontology in the American Museum of Natural History; and on October 17 he presided over a new Biological Section of the New York Academy of Sciences, which he has been mainly instrumental in founding, and which will hold monthly meetings.

THE inaugural "Robert Boyle Lecture," delivered last May before the Oxford University Junior Scientific Club, has now been published. Sir Henry W. Acland has fittingly taken for the subject of this lecture the life of Boyle, whose many-sided studies he speaks of in detail. The value of Boyle's work is thus summarised: "It is probable that the greatest service he did to his country and to mankind, was by kindling in the minds of his contemporaries an enthusiasm for science, a desire to explore and know Nature."

NATURAL Science is specially honoured this year by the Royal Society of London in the person of Professor Rudolf Virchow, who receives the Copley Medal for his researches in pathology, pathological anatomy, and prehistoric archæology. A Royal Medal is awarded to Mr. J. N. Langley in acknowledgment of his researches on secreting glands and on the nervous system. The Darwin Medal is appropriately offered to Sir Joseph Hooker, one of the earliest supporters of the author of "The Origin of Species." The Annual Meeting of the Royal Society is held on November 30, and the Biologists and Geologists nominated for the new

Council include Professor Bayley Balfour, Mr. F. Du Cane Godman, Professor J. G. McKendrick, Dr. W. T. Blanford and Mr. Adam Sedgwick. The officers remain as before.

THE Rev. Leonard Blomefield (formerly Jenyns) joined the Linnean Society on November 19, 1822, and at the meeting of the Society on November 17 an address of congratulation to him was moved and heartily passed on the occasion of the virtual completion of his seventy years' Fellowship of the Society—a period scarcely likely to be matched in the annals of any other learned Society. Mr. Blomefield was offered the appointment of naturalist to the "Beagle," and it was on his finding himself unable to proceed on the voyage that Mr. Darwin's opportunity came. He described, however, the fishes obtained on the voyage of the "Beagle" in a book of very great value to students of fishes. He enjoys excellent health, and we trust will long be spared as the oldest Fellow of the Society.

THE Norwich Science Gossip Club, which was founded in 1870 by Dr. J. E. Taylor, F.L.S., consists of 74 ordinary and eight honorary members, and so far as we know it fills a unique position among the learned societies. The object of this Club is the promotion among its members of a spirit of enquiry and the investigation of scientific and literary knowledge, by means of fortnightly papers, and occasional excursions. The evening meetings are held at the Royal Hotel, Norwich; tea coffee, and other beverages may be ordered before or after the reading of a paper, and the proceedings are conducted amid a fragrant cloud of tobacco-smoke. To this social feature the Club, no doubt, owes much of its long-continued success but the papers read, to judge from the last published Report of Proceedings, are of a varied and interesting nature, they are carefully prepared, and to them in particular is to be attributed the fact that "every evening has been pleasant and instructive." Mr. M. P. Squirrell, of Norwich, has been elected President for the Session 1892-93.

THE Royal Scottish Geographical Society has organised in connection with its Education Scheme, two courses of lectures to be delivered this session in Edinburgh. Before Christmas Mr. J. G. Goodchild, of the Geological Survey, treats of Volcanoes in six lectures; and after Christmas Mr. J. Arthur Thomson will undertake a course on the Geographical Distribution of Plants and Animals.

THE Naturforschende Gesellschaft of Danzig celebrates its 150th anniversary on January 2 and 3, 1893. Societies desiring to send representatives should communicate with Professor Dr. Conwentz, the Secretary. The naturalists of Danzig have displayed much activity of late years, especially in geological researches, and many valuable memoirs hail from the remote German city.

THE principal paper in the current number of the *Proceedings of the Cotteswold Field Club* deals with "Some Laws of Inheritance, and their Application to Man." The author, Mr. S. S. Buckman, is one of that numerous body of naturalists who refuse to believe with Weismann in the non-heredity of "acquired characters"; and in applying his views (originally derived from a study of Ammonites) to man, furnishes, incidentally, a considerable amount of very good reading. He extends Dr. Louis Robinson's investigations upon the manners and customs of the newly born child, and finds relics of monkeyhood everywhere; it is even boldly suggested that the lines, "Lull-a-by baby on the tree top," drew their inspiration from oral tradition of a former arboreal existence. A baby, too, we are told, "seldom refuses a bone, even after the very fullest meal"; this, perhaps, is not especially ape-like, but, on the whole, the application of the term "young monkey" to children, is one of those truths often said in jest.

THE Session of the tenth Congress of the American Ornithologists' Union was opened at Washington on November 15.

OBSERVATIONS AND CORRESPONDENCE.

The Geological Society of London and Equity.

While I am much obliged for the notice taken in the current No. of Natural Science (p. 654) of my last paper at the Geological Society, I must ask to be allowed to say a few words from my point of view. All that is quoted from Professor Judd's Address of 1888 most reasonable people would be prepared to endorse; but it is altogether wide of the point. If the Council of the Society applied such a principle fairly and *consistently*, no one would have any just cause of complaint It is, however, because they have, while suppressing a mass of new evidential facts during the last two years on one side of the controversy, given space, to the extent of eleven pages of the Society's *Journal*, to "A paper [which] is a controversial one, and deals with a number of minor points connected with the stratigraphy of the Bagshot Area," and deals, moreover, in part with a number of minor points belonging to that part of the area which I had specially reserved for further investigation, while it ignores many facts now well-established, and goes out of its way to criticise some things in my earlier papers which have been superseded in my later papers, that I feel they have treated me unfairly.

I make allowance for the human nature to be found in any average body of some two dozen fairly educated men, which accounts, perhaps, for their unwillingness to publish my last paper, and I make full allowance for that intellectual colour-blindness in a referee which may result from what has been called "unconscious cerebration"; and so my quarrel resolves itself into a raid upon the system rather than upon individuals. A great deal may be said—as I know very well—for the referee system, but the responsibility for their own action must abide with the Council; and if the affairs of the Society had not got rather into a groove detrimental in every way to true science, it would not be necessary for me to suggest that the occasional appointment at least of a "standing committee" would be a useful innovation upon traditional procedure. A. Irving.

Wellington College, Berks.

The Parasites of Cut Corks.

In answer to the query proposed under the above title, I would refer Mr. J. Lawrence Hamilton to a short note on "Insect Damage to the Corks of Wine Bottles" (in *Insect Life*, vol. i., no. 3, p. 91, 1888), which may be of some use to him. It is the summary of a paper by M. Preudhomme de Borre, read at the Entomological Society of Belgium on May 7, 1887. Two species of insects, *Oenophila v. flavum* and *Rhizophagus bipustulatus* are described as eating holes through the corks. The eggs are often deposited in the cork while on the tree, so that it is likely every form of cork may be infested. Some other insects are mentioned as being similarly troublesome.

Paris. Henry de Varigny.

TO CORRESPONDENTS.

All communications for the Editor *to be addressed to the* Editorial Offices, 67–69 *Chancery Lane, London, W.C.*

ERRATA.

P. 555, line 18.—*For* Firth of Forth *read* Firth of Clyde.

P. 688, lines 16, 17.—*For* "they get their" *read* "the ash gets its."

P. 703, line 23.—The price of Ward's "Horn Measurements" is £1 1s. (not £1 10s., as stated).

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